1 Source

1.A Facility Description
As a national facility for defense and civilian research in condensed-matter science, radiography, and nuclear science, LANSCE supports a User Program open to researchers from universities, industry, the Laboratory, and other national laboratories, as well as research facilities from around the world. LANSCE comprises a high-power, 800-MeV proton linear accelerator; a Proton Storage Ring (PSR); moderated neutron production targets at the Manuel Lujan Jr. Neutron Scattering Center (Lujan Center); the Weapons Neutron Research (WNR) facility; a proton radiography (PRAD) facility; an isotope production facility (IPF) (under construction); and a variety of spectrometers, beam lines, and specialized instrumentation. The LANSCE accelerator complex provides the highest power proton accelerator in the world, the most intense high-energy neutron source in the world, and the highest peak flux thermal/cold pulsed neutron source in the world. LANSCE has recently demonstrated the highest density of ultra-cold neutrons in the world. LANSCE provides unique capabilities or world-class neutron fluxes over a range of 17 orders of magnitude in neutron energy. Researchers may apply for beam time by completing a proposal, which is subjected to appropriate peer review before beam time is granted. Once beam time is granted, the experiment is reviewed for technical and safety issues before accepting beam. Information about LANSCE and a blank proposal form are available at http://lansce.lanl.gov/.

1.A.1 High-Intensity Proton Linear Accelerator
The LANSCE high-intensity, 1-MW proton linear accelerator can simultaneously accelerate H^+ and H^- ions to an energy of 800 MeV. The three-stage, half-mile-long linear accelerator can provide H^+ beam with an average current of up to 1.2 milli-A at a repetition rate of 120 Hz. The H^- beam can also be delivered at 120 Hz, though in normal operation only 20 Hz is delivered to the Lujan Center target.

The first stage of the accelerator contains injector systems for H^+ and H^-. Each injector system has a 750-keV Cockroft-Walton generator and an ion source. The two ion beams are merged, bunched, and matched into a 201.25-MHz drift-tube linear accelerator for further acceleration to 100 MeV. The third and longest stage of the accelerator (800 m) is the side-coupled-cavity linear accelerator—here particles are accelerated to their final energy of 800 MeV.

The particle beams from the linear accelerator are separated and directed down three main beam lines that lead to several experimental areas, including Areas A, B, and C; the Lujan Center; and the WNR facility. Operators can control the H^+ and H^- beams separately so some experiments can run simultaneously.

1.A.2 Proton Storage Ring (PSR)
The PSR converts H^- macropulses that are approximately 750 µs long into short (0.27 micro-s), intense proton (H^+) bursts that provide the capability for precise neutron time-of-flight measurements for a variety of experimental programs. The H^- beam is converted to H^+ by removing its two electrons using a stripper foil in the injection section of the PSR. The injected proton beam has a substructure of several thousand “micropulses” produced by the acceleration process. The PSR collects these micropulses into one high-intensity pulse and ejects that pulse toward the neutron target (located in the Lujan Center). In normal operation, the PSR empties to the Lujan target at 20 Hz.

1.A.3 Neutron Production at the Lujan Center
The spallation reaction occurs when protons strike a tungsten target and produce neutrons from the nuclei of the target atoms. For the 800-MeV proton beams used at LANSCE, about twenty neutrons per proton are ejected. These very high-energy neutrons are thermalized to low energy in six distinct moderators. The Lujan moderators include four water moderators and two liquid hydrogen moderators.

The four “lower-tier” moderators (three water and one liquid hydrogen) each serve three beam lines. Like moderators at other spallation sources, three of these moderators are “decoupled” with neutron-absorbing materials to ensure a short neutron pulse and to suppress the long time “tail.” While this “decoupling” is very effective for certain classes of high-resolution experiments, it is costly in that total neutron flux is reduced by as much as a factor of five to six. The fourth lower-tier moderator is “partially coupled” in that there are no neutron absorbers in the immediate vicinity of the moderator volume. This partial coupling provides an increase of about three times the integrated cold neutron flux and has already shown its value in significantly improved reflectometer and small angle scattering performance. Particularly noteworthy at the Lujan Center are the two “upper-tier” moderators (one water and one liquid hydrogen) that are “fully coupled” in that all neutron absorbers are very far from the moderators. These quite unique moderators are expected to enhance the integrated cold neutron flux by about five to six times. The Lujan Center is the only facility in the world where there is the opportunity to explore the utility of partially coupled and fully coupled moderators.

1.A.4 Experimental Facilities

1.A.4.1 Manuel Lujan Jr. Neutron Scattering Center (Lujan Center)

At the Lujan Center, moderated spallation neutrons are used for neutron scattering, as well as nuclear-science research. Because of the PSR’s high average current, a low duty cycle (20 Hz), and the unique design of the split tungsten target and novel moderators, the Lujan Center yields a higher peak neutron flux than any other spallation neutron source available for neutron scattering. Of the 16 flight paths (which currently provide 17 independent neutron beams), 7 have instruments for neutron scattering, 2 are used for nuclear-science research, and the remainder are being instrumented (see Section 2, Instruments and Flight Paths).

1.A.4.2 Weapons Neutron Research Facility (WNR)

At the WNR facility, high-energy, unmoderated neutrons and protons are used for basic and applied research in nuclear science and weapons-related measurements. The WNR facility consists of two target areas, Target 2 and Target 4, and their associated flight paths. At Target 2, also known as the Blue Room, proton-induced reactions can be studied using the linear accelerator or the PSR proton beam. A low-background room with seven flight paths complements this target. Experiments in the Blue Room can exploit the variable-energy feature of the linear accelerator using proton beams from 250 to 800 MeV. Target 4 is the most intense high-energy neutron source in the world. At this target, the proton beam from the linear accelerator is used to produce neutrons for the study of neutron-induced reactions, single event upsets in semiconductors, and a variety of other studies. Target 4 consists of a "bare" unmoderated neutron-production target and six flight paths that have flight-path distances ranging from 10 to 90 m at angles of 15° to 90° with respect to the proton beam. The shape of the neutron spectrum ranges from a hard (high-energy) spectrum at 15° to a softer (lower-energy) spectrum at 90°. The time structure of the proton beam can be modified for particular experiments.

1.A.4.3 Proton Radiography (PRAD)

In Area C, H^- beam from the linear accelerator is used as a new radiographic probe for creating multiple high-resolution images of imploding or exploding objects on a submicrosecond time scale. Because protons interact with matter through strong electromagnetic forces, measurements of different material properties, such as material density and composition distributions, can be made simultaneously. In addition, protons have high penetrating power, can be detected efficiently, produce very little scattered background, and have an inherent multiple-pulse capability. Los Alamos researchers are developing PRAD as a tool for the better understanding of explosively driven phenomena for defense-science applications, but there is also very significant interest in industrial applications of PRAD. This is the only proton radiographic facility in the world.

1.A.4.4 Isotope Production Facility (IPF)

To ensure that U.S. clinicians and researchers have a steady supply of medical isotopes, the Laboratory is currently building a new IPF to replace an existing facility. Construction of the $16.5 million IPF began in February 2000 and should be completed in June 2002. Once operational, the IPF will support eight months of isotope production annually to ensure that doctors and researchers have an adequate, year-round supply of accelerator-produced medical isotopes. The new facility will irradiate a wide range of materials, including rubidium chloride and gallium, using a portion of the LANSCE proton beam. The targets will then be shipped to Los Alamos National Laboratory's Technical Area 48 for isotope processing and recovery. The IPF will use the H^+ beam and its operation will have no impact on Lujan Center operations.

1.B Source Performance

1.B.1 Lujan Center Days Available versus Days Scheduled for Users

	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000
Days Available by Budget*	55	153	152	78	108	130
Days Scheduled for Users	55	117	150	0	108	39
Days Delivered to Users	35	98	135	0	30	31

*Definitions used here are those as defined by the annual Basic Energy Sciences (BES) user facility report.
Days available by budget = total theoretical time – scheduled downtime for machine studies, maintenance, safety, commissioning, or holidays – the amount of time a facility cannot be operated due to funding constraints.

1.B.2 Overall Reliability of the Source

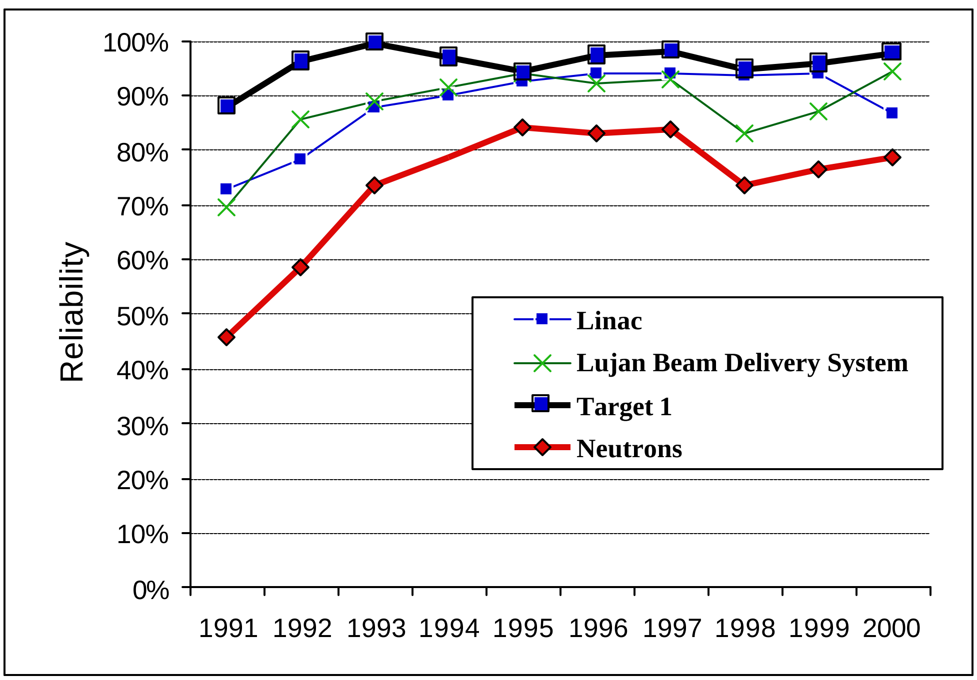


Figure 1. This chart shows the reliability of the linear accelerator, Lujan Center beam delivery system, and Target 1 (Lujan target) for each calendar year since 1991. The data for 2000 is current through October 2000.

1.B.3 Actual Run Time Compared to Advertised Schedules

LANSCE Division's stated goal for CY1999 was to operate the User Facility for six months. Once final budget allocations for FY1999 were known in January 1999, it became obvious that this goal could not be achieved. Given the magnitude of the shortfall, the only recourse seemed to be to curtail operation of one of the experimental areas. Planning for reduction of WNR operation was in progress when all beam operations were interrupted by a safety stand down ordered by LANSCE management on February 5, 1999. This safety stand down lasted approximately four months during which time a great deal of effort was directed toward the remediation of many safety and legacy issues. The linear accelerator restart began early May 1999 and operations for PRAD and WNR resumed shortly thereafter. The restart of the Lujan Center was delayed for an additional 10 months due to more stringent “licensing” requirements by DOE.

According to DOE regulations, the Lujan Center target is a “Category 3” nuclear facility based on the inventory of radionuclides in the target after exposure to the accelerator beam. As a Category 3 nuclear facility, it requires an “Authorization Basis” (the DOE term for a “license” to operate). The Lujan target authorization basis expired in March 1999. In the past, the renewal of this authorization basis (last completed in November 1998) was a relatively straightforward, predictable process requiring a few months effort (see Appendix C, LANSCE Chronology). In 1999, however, DOE required an increased level of rigor. The process required the equivalent of several man-years of effort and the expenditure of greater than $1 million in operating funds. Following a series of rigorous “Readiness Assessments,” the Lujan Center restarted operation in June 2000.

The delay in restarting the Lujan Center did allow considerably more time to be devoted to researching the PSR instability than had been planned—to the great advantage of the Short Pulse Spallation Source (SPSS) Enhancement Project. Record stored charge in the PSR demonstrated that the SPSS goal of 200-microamp operation is well in hand. The delay also allowed for the installation of four much-improved mercury beam shutters at the Lujan Center without exposing the installation crews to levels of radiation that would have been seen with an extensively irradiated spallation target. That job was completed on schedule, with an accumulated dose of less than 300 mrem to the installation crews.

1.B.4 Quantity and Quality of Beam

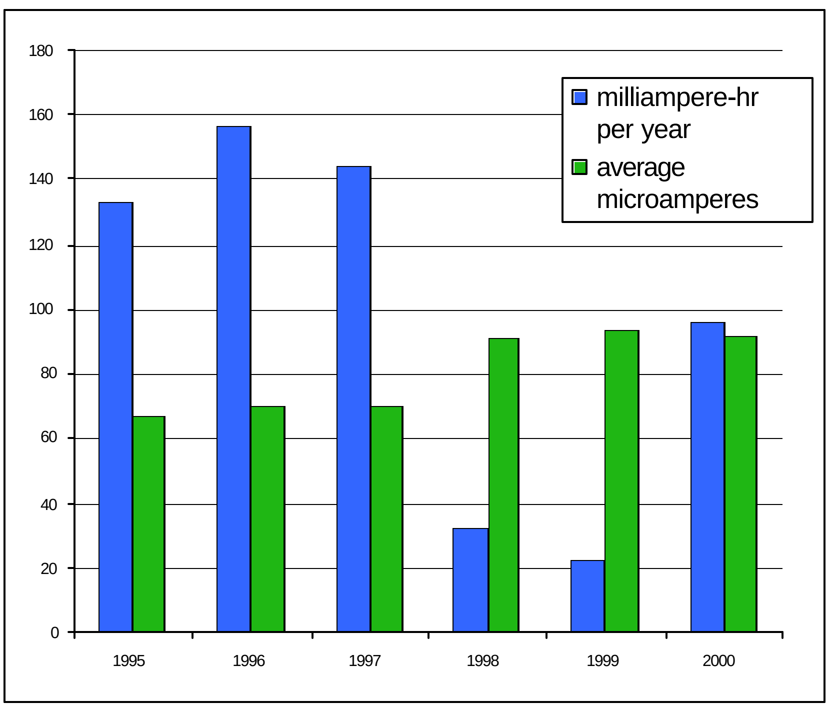


Figure 2. The graph illustrates the number of milliampere-hours delivered per year, from 1995-present, and the average delivered microamperes over the calendar year. Year 2000 data is current through October 2000; milliampere-hours can be expected to increase by about 40 percent reflecting anticipated operation in November and December.

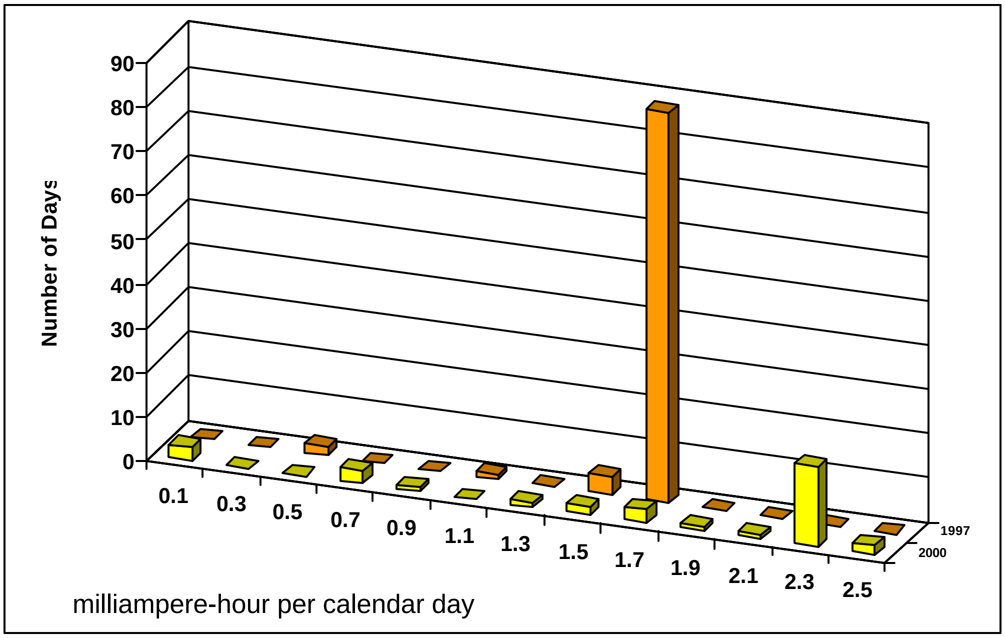


Figure 3. Frequency distribution of daily charge delivered to the Lujan Center Target in 1997 and 2000. Only days fully scheduled are included. Calendar year 2000 data is for the period from August 6-October 31.

2 Instruments and Flight Paths

2.A Current Instrument Suite

The 16 beam penetrations at the Lujan Center are currently equipped with 7 neutron scattering and 2 nuclear physics instruments. The 16 flight paths (FP), as currently configured, can serve 17 instruments (1 flight path has a split guide system). There are two high-intensity, decoupled water moderators (FPs 3-8) and one decoupled water moderator tailored for high resolution (FPs 1, 2, and 16). One water moderator is fully coupled (FPs 14-15). A partially coupled liquid hydrogen moderator serves FPs 9-11, while the fully coupled liquid hydrogen moderator serves FPs 12 and 13. See Section 2.E for descriptions of new instruments and instrument upgrades in progress or planned over the next five years.

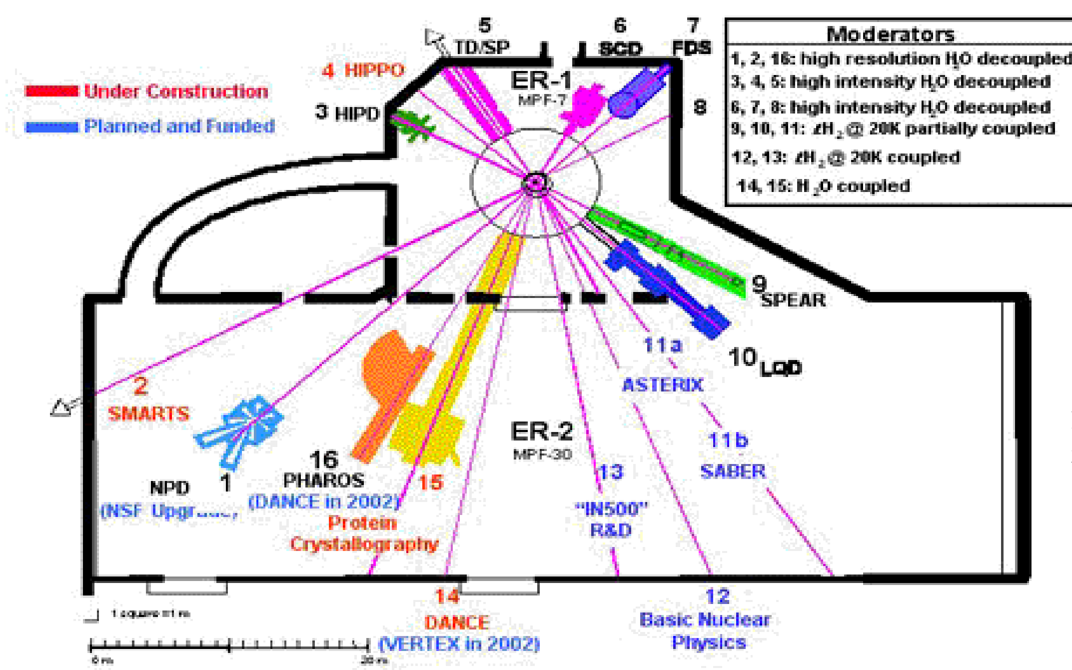


Figure 4. Lujan Center instrument suite.

Neutron Powder Diffractometer (FP 1). The Neutron Powder Diffractometer (NPD) allows for studies of complex structures, internal strain measurements, and phase transformations. Examples of recent experiments include studies of internal stresses and phase transformations in shape memory and superelastic NiTi; phases of Pu alloys; strains in nanocomposites; residual strains in intermetallic composites, NiAl; strain measurements in tempered ceramics; and elastic and plastic anisotropic effects in fcc polycrystals. The standard collimation produces a 5 x 10 millimeter beam at the sample position. Four detector banks (each 31 ^{3}He 30-cm tubes) sit symmetrically about the sample position at ±90 and ±148 degrees, covering a d-spacing range of 0.25 to 4 Angstroms. The resolution in the backscattering detectors is $\Delta d/d = 0.15\%$, and at 90°, it is 0.25%. For strain measurements, a set of radial collimators defines the diffracted beam volume and a focusing optic is available to increase the beam intensity when sampling small volumes. Ancillary equipment available includes a displex, orange cryostat, high-temperature furnace with atmosphere control, compact stress rig, and beam-collimation system for strain measurements.

High Intensity Powder Diffractometer (FP 3). The High Intensity Powder Diffractometer (HIPD) is designed to study the atomic structure of materials that are available only in polycrystalline or noncrystalline forms. The beam collimation directs the neutrons into the sample chamber with detectors located at ±153°, ±90°, ±40°, and ±14°, each covering ±5°. Over two decades of momentum transfer are available (0.2-60 Angstroms $^{-1}$) to support studies of amorphous solids, magnetic diffraction, small crystalline samples, and samples subjected to extreme environments such as temperature, pressure, or magnetic fields. The exceptionally high data rates of HIPD also make it useful for time-resolved studies. In addition to the standard ancillary equipment (closed-cycle He refrigerator, furnace, texture goniometer), HIPD has a unique high-pressure cell capable of achieving pressures of 10 GPa at ambient temperature with samples up to100 mm^3 in volume. In addition, this cell can be used simultaneously at high pressure and high temperature, having achieved 7 GPa at 1600 K.

Single Crystal Diffractometer (FP 6). The Single Crystal Diffractometer (SCD) is used to determine the crystal structures of a wide variety of materials. Neutrons are scattered from the crystalline sample onto an area detector that measures 25 x 25 cm, situated at 265 millimeters from the sample. To collect all the required data to achieve a structural solution for a particular crystal, a goniometer is used to reorient the sample. SCD has been used to study the structure of organometallic molecules, unique binding of H_2, crystal structure changes at solid-solid phase transitions, magnetic spin structures, twinned or multiple crystals, and texture. Because the instrument measures a large volume of reciprocal space, it has been used for studies of unknown incommensurate structures and diffuse scattering.

Filter Difference Spectrometer (FP 7). The Filter Difference Spectrometer (FDS) is designed to determine energy transferred to a sample by measuring the changes in the energies of the scattered neutrons. FDS is most useful for measurements requiring high sensitivity, such as dilute systems and vibrations of molecules adsorbed on surfaces. The scattered neutrons pass through Be or BeO filters that determine an upper bound on the final energy. An energy resolution of about 1.5 to 2% can be achieved over most of the accessible energy range (13-620 meV) by using a maximum-entropy deconvolution of the data. FDS is best used to observe excitations with little or no dispersion. Examples of recent studies include interactions of adsorbates in zeolites, investigations of hydrogen dynamics in molecules and metals, and energy-transfer mechanisms in high explosives.

Surface Profile Analysis Reflectometer (unpolarized, SPEAR) (FP 9). The Surface Profile Analysis Reflectometer (SPEAR) is used with an unpolarized neutron beam to study solid/solid, solid/liquid, solid/gas, and liquid/gas interfaces. SPEAR's moderated neutrons are coarsely collimated into a beam with an average angle of 0.9° to the horizontal that converges at the sample position, which is 8.73 m from the moderator. The neutrons can be further collimated to the desired divergence by finely slitting the beam. The largest beam divergence within the scattering plane of the sample is 0.8° and the horizontal resolution is ±0.25°. A frame-overlap chopper defines the wavelength band to be used, usually either 1-16 or 15-32 Angstroms. A goniometer at the sample position allows solid samples to be accurately tilted in order to change the angle of incidence of the beam relative to the reflecting surface. A vibration isolation system supports the sample and actively dampens vibrations transmitted through the floor or air. SPEAR uses a single ^{3}He detector for low-reflectivity studies or a single linear position-sensitive detector with 2-millimeter resolution for studies of off-specular scattering. A Langmuir trough, a Poiseuille shear cell, a controllable humidity oven, a ultrahigh-vacuum (UHV) evaporator, and a UHV oven are available.

Surface Profile Analysis Reflectometer (polarized, P-SPEAR) (FP 9). The flight path serving the neutron reflectometer can be configured to furnish a polarized neutron beam and to provide full polarization analysis of the neutron radiation scattered by materials. The neutron wavelengths polarized and analyzed by the supermirror polarizers cover the range of 2 to 6 Angstroms. The wavelength range can also be shifted to larger wavelengths, e.g., 4 to 12 Angstroms, if desired. A pair of spin-turn coils whose flipping ratio exceeds 20 controls the polarization state of the beam. The instrument for polarized neutron studies provides the capability to measure the four neutron cross sections (two spin-flip and two non-spin-flip) of the neutron beam in the small-angle regime, suitable for reflectometry or transmission depolarization studies. In the wide-angle regime used in diffraction studies, only the two non-spin-flip cross-sections are presently measured. Samples can be cooled to 12ºK with a Displex cryostat, or heated to 1000ºK with a furnace. The cryostat and furnace can be accommodated between the 25 millimeter-spaced poles of an electromagnet, which produces a field up to 1 T at this separation. Samples used for reflectivity measurements are typically 25 x 25 millimeters in area and up to a few thousand Angstroms thick. Samples used in diffraction experiments are typically cylindrically shaped with diameters and lengths less than 10 millimeters. A UHV evaporator for *in situ* preparation of samples is also available.

Low-Q Diffractometer (FP 10). The Low-Q Diffractometer (LQD) is designed to study structures with dimensions in the range from 10 to 1000 Angstroms. A significant feature of the LQD is that it measures a broad Q-range (0.003 to 0.5 Angstroms $^{-1}$) in a single experiment without any changes to the instrument's physical configuration. The LQD requires an intense source of long-wavelength neutrons; therefore, it views a liquid-hydrogen moderator. A pair of single-aperture collimator plates yields an angular resolution of 0.09° and a penumbra diameter of 10 millimeters at the sample. The LQD is useful in addressing problems of critical phenomena, colloid structure, biomolecular organization, phase separation, and phase morphology and molecular conformation in polymers. Ancillary equipment includes a closed-cycle He refrigerator, a pressure cell (up to 3 kbar), and a shear cell.

High-Resolution Chopper Spectrometer (FP 16). The High-Resolution Chopper Spectrometer (PHAROS) is designed for low-angle studies such as neutron Brillouin scattering and magnetic excitations by using its low-angle bank. Currently PHAROS is receiving its first detectors in the wide-angle detector bank, a new turn-key Fermi chopper system, and a new data-acquisition system. The instrument provides 0.5% incident energy resolution for incident energies between 50 milli-eV and 2 eV. A wide-angle detector bank covering –10° to 140° allows PHAROS to accommodate the full range of inelastic scattering experiments, including phonon densities of state, magnetic excitations, momentum distributions, crystal-field levels, chemical spectroscopy, and measurements of $S(Q,\omega)$ in disordered systems. The low-angle bank allows for angles down to 0.65°, making it suitable for high-resolution inelastic studies at low Q.

Resonance Radiography (FP 5). FP 5 is a general-purpose nuclear physics flight path used to study the Doppler shift and broadening of low-energy nuclear resonances. FP 5 can also be used for transmission Bragg edge diffraction.

***General Purpose Cold-Neutron Beam Line* (*FP 11A*).** FP 11A is used for nuclear and fundamental neutron physics experiments (including the study of parity violation in the reaction $n + p \rightarrow d + \gamma$ and experiments to measure the neutron electric dipole moment) and has in the past been used for investigations employing pulsed-cold-neutron radiography. The new Asterix instrument will employ this beam line in 2001 (see description under Section 2.E). The nuclear physics program will move to the fully coupled moderator on FP 12.

2.A.1 Communities Served by Instruments

See instrument descriptions in Section 2.A, Current Instrument Suite, and Section 2.E, Investment in Instrument Suite, for those scientific communities served by the various instruments.

2.A.2 Instrument Rankings

Current Instruments	Instrument Capability Ranking[1]	Quality of Science Ranking[2]
Neutron Powder Diffractometer (NPD)	1	1
High Intensity Powder Diffractometer (HIPD)	2	2
Single Crystal Diffractometer (SCD)	2	2
Filter Difference Spectrometer (FDS)	3	1
Surface Profile Analysis Reflectometer – (unpolarized) (SPEAR)	1	1
Surface Profile Analysis Reflectometer – (polarized) (P-SPEAR)	2	2
Low-Q Diffractometer (LQD)	2	2
High-Resolution Chopper Spectrometer (PHAROS)	2	3
Resonance Radiography (nuclear science FP)	3	2
Cold-Neutron Beam Line (nuclear physics FP)	1	1

[1] 1 = world class, 2 = useful research tool, 3 = outdated
[2] 1 = world class, 2 = competitive, 3 = limited impact

2.B Instrument Loss Statistics

Instrument availability is tracked automatically with current and past data available via the web (see http://inpeach.lansce.lanl.gov:8080/metrics/metrics.html). Instrument downtimes over 24 hours for the neutron scattering spectrometers are analyzed to determine the origin and develop a solution(s) to the problem. In addition, recommended changes to prevent recurrence are required. During the 1997 run cycle, there were four such instances of instrument downtime.

- A catastrophic failure of the bearing on the PHAROS t-zero chopper occurred due to bearing failure. The chopper shaft was damaged and needed repair, which also required rebalancing of the t-zero chopper. Short-term preventative measures were to return to the original bearing, eliminate play on the chopper shaft, install temperature and vibration monitoring, and rewrite the maintenance procedure. The long-term solution was the implementation of a formal preventive maintenance program.
- An electrical overload caused the PHAROS t-zero chopper and its vacuum pump to shut down unexpectedly. The vacuum pump was moved to a separate electrical circuit. The long-term action is to upgrade electrical utilities at the Lujan Center.
- The helium cooling system for the liquid hydrogen moderator failed. The electrical generator and the drive motor failed due to inadequate preventive maintenance. The long-term action was to transfer the responsibility to another LANSCE group with a larger pool of experienced people charged specifically with the operation of the Lujan Center target moderator system.

- Beam time on P-SPEAR was lost due to the illness of the instrument scientist for three days. There was no alternative expertise to operate SPEAR in the polarized mode. No short-term actions were taken, but the long-term action was the hiring of a postdoc to assist on P-SPEAR.

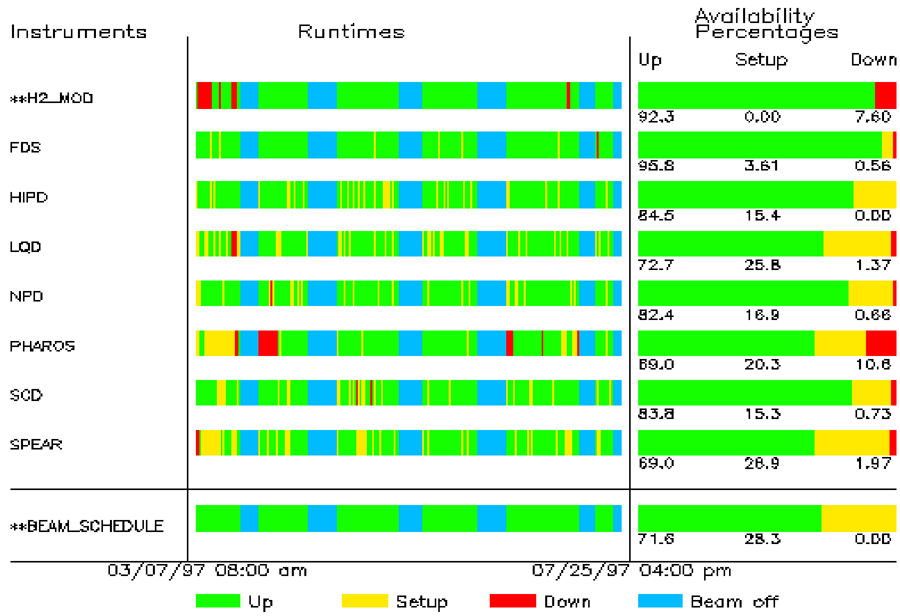


Figure 5. Overall instrument availability (1997 run cycle).

2.C Availability of Beam Time to Groups

Of the total amount of beam time available to users, 80% is reserved for users as recommended by the Program Advisory Committee (PAC). The PAC is informed regarding the total number of days this 80% represents during each review cycle and uses this information in formulating their recommendations for beam-time allocations, including a small amount of "stand-by" proposals over the 80% allotment. The remaining 20% of beam time is used for calibration and instrument development, or is allocated as discretionary time. Discretionary time is used for standby-rated proposals or for new, novel proposals that were submitted after the scheduled proposal call and review process.

Beam Time Made Available to Groups (in days available and percentage of days for FY)						
	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000
External Users	44/80%	94/80%	120/80%	0	108[1]	39[1]
Instrument Scientists	11/20%	23/20%	30/20%	0		
Director's Discretion	Allocated by the Director to instrument scientists as discretionary time.					
Other Internal Usage[2]						

[1]Due to the backlog of experiments from the recent shutdown, proposals were not solicited for FY1999-2000. Experiments run during that period were selected from among proposals that had been granted time by the PAC in 1998 and from updated proposals concerning more recent technical questions.
[2]Calibration beam time is included in discretionary time. No commissioning time was used during the years covered. Commissioning time for new instruments will be allocated outside of beam time available to users.

2.D Days Requested and Days Delivered by Discipline

All LANSCE proposals (since 1996) contain information regarding the relevant disciplines for each proposed experiment. A given experiment may benefit multiple discipline areas. LANSCE proposals are not weighted or categorized under one primary discipline only; authors are asked to indicate, for each proposal, all areas that apply to the proposed experiment. The following statistics show the percentage of proposals requesting beam time in a particular discipline. For example, in 1998, 78% of the proposals requesting time (and thus, 78% of the beam time) on HIPD pertained to materials science research.

Note that LANSCE has not issued a general proposal call for the Lujan Center since 1998 but ran experiments from proposals that had been allocated beam time during that PAC round. Proposal discipline categories were expanded in 1998 to be consistent with the annual BES User Facility report.

		CY96	CY97	CY98
HIPD	Biological/Life Science	2%	2%	2%
	Chemistry	16%	13%	29%
	Defense Science	6%	5%	35%
	Earth Sciences	14%	16%	10%
	Engineering	6%	2%	6%
	Environmental Sciences			10%
	Materials Science	57%	66%	78%
	Medical Applications		2%	
	Solid State Physics	8%		47%
	Days Requested	276.5	200	222
LQD	Biology/Life Sciences	25%	16%	25%
	Chemistry	6%	11%	13%
	Defense Science	19%	11%	17%
	Engineering	6%	5%	13%
	Materials Science	50%	58%	79%
	Medical Applications	13%		8%
	Other	13%	21%	4%
	Polymers			21%
	Solid State Physics			25%
	Days Requested	68.5	74	96.5
NPD	Chemistry			7%
	Defense Science	9%	4%	21%
	Earth Sciences			4%
	Engineering	21%	25%	21%
	Environmental Sciences			4%
	Instrument Development			7%
	Materials Science	83%	82%	86%
	Solid State Physics			18%
	Days Requested	184.5	178	190.0
PHAROS	Biology/Life Sciences	13%		5%
	Chemistry	13%		5%
	Defense Science			10%
	Materials Science	50%	80%	62%
	Other		10%	5%
	Polymers			5%
	Solid State Physics			76%
	Instrument Development			5%
	Days Requested	84	139	219.0
FDS	Chemistry	29%	50%	85%
	Defense Science		8%	8%
	Engineering			8%
	Materials Science	43%	33%	38%
	Polymers			8%
	Materials Science	33%	75%	67%
	Solid State Physics			8%
	Days Requested	94.5	86	91
SPEAR	Biology/Life Sciences	11%	11%	42%
	Chemistry	23%	22%	33%
	Defense Science	6%	6%	6%
	Engineering	14%	17%	12%
	Environmental Sciences	3%		3%
	Instrument Development			15%
	Materials Science	69%	100%	82%
	Medical Applications	6%	11%	21%
	Polymers			64%
	Solid State Physics	3%		12%
	Days Requested	188	96.5	228.5
SCD	Chemistry	33%	17%	22%
	Solid State Physics			22%
	Earth Sciences	17%	8%	
	Days Requested	92	101	71.5

2.E Investments in Instrument Suite

Four instruments are under construction (three for neutron scattering and one for nuclear physics), two more neutron scattering instruments are approved for construction under the SPSS enhancement program, one new nuclear physics instrument is funded, and LDRD (institutional funds) funding exists for two additional instruments. Instruments under construction include the following.

High Pressure-Preferred Orientation (FP 4). The High-Pressure Preferred Orientation (HIPPO) instrument is a high-intensity powder diffractometer that will be commissioned in CY2001 primarily for high-pressure, texture, liquid/amorphous materials, and reaction-kinetics studies. It features a short, initial flight path of 9 m and an array of 1400, 10-atm ^{3}He detector tubes covering more than 4.5 m^2 with five detector banks at scattering angles ranging from backscattering (nominally 150°) to low forward scattering (nominally 10°). The collimation system converges to a maximum round beam size of 2 cm diameter at the sample position. Smaller beam sizes at the sample position can be produced with adjustable collimation. It is anticipated that the data collection times for some experiments will enable measurements in as little as 5 to 10 s. The HIPPO diffractometer can be applied in a wide variety of disciplines such as materials science and engineering, earth sciences, physics, and chemistry. Examples of research include kinetics of reactions; high-pressure investigations of complex systems with large sample volumes, texture evolution in polycrystals during deformation, recrystallization and phase transformations, texture and anisotropy of rocks (e.g., granite-mylonite, mantle peridotites), crystal structure of zeolites, and structure of liquids and melts. It will be possible to perform time-dependent experiments on bulk anisotropic samples at a wide range of temperature and pressure conditions.

Spectrometer for Materials Research at Temperature and Stress (FP 2). The Spectrometer for Materials Research at Temperature and Stress (SMARTS), to be commissioned in CY2001, will be a third-generation neutron diffractometer dedicated to structural materials studies. SMARTS will dramatically expand LANSCE capabilities into areas of research not currently possible by increasing the maximum attainable temperatures and stresses, separately and in combination; by providing an *in situ* stress corrosion monitoring capability; and by reducing sampling volumes used in spatially resolved work. Principal goals for SMARTS include 1 mm^3 sampling volumes for spatially resolved strain and texture profiles within components; *in situ* uniaxial loading on samples up to 1 cm in diameter to in excess of 2GPa at temperatures up to 1500°C, and *in situ* reaction or phase-transformation studies at temperatures up to 2000°C. The space in the spectrometer will allow components of dimensions up to 1 m and masses up to 1 ton to be mounted in the beam. Another critical feature of the SMARTS design is the ability to permanently mount alignment telescopes several meters from the specimen position, providing a simple and efficient way to line up samples or equipment in the beam to within 0.01 millimeter accuracy. SMARTS provides an efficient compromise between the needs of high intensity for spatially resolved work and high resolution for resolving the performance of individual hkl reflections necessary for testing models of polycrystalline deformation or for strain deconvolution.

Protein Crystallography Station (FP 15). The Protein Crystallography Station (PCS) is a single crystal diffractometer designed for structure determinations of large biological molecules. The instrument will be used to locate hydrogen atoms, solvent molecules, and integral components in crystals of proteins, nucleic acids and carbohydrates, and fibers of biological polymers and membranes. The instrument will view a fully coupled water moderator and will feature a large 120° x 16° position sensitive detector and a kappa goniometer with a cryomagnet. This instrument will be the first dedicated instrument to exploit a spallation neutron source for the determination of the structures of important biological molecules.

Asterix (FP 11A). Asterix is funded through LDRD (institutional funds) to provide for the development of polarized-beam capability for diffraction studies of magnetic materials at high magnetic fields and will utilize polarized neutron reflectometry. Asterix will view the lower-tier, partially coupled liquid hydrogen moderator.

DANCE (FP 14). This nuclear physics flight path will be used for the study of neutron capture on radioactive nuclei. This work will support the stockpile stewardship program and provide useful information for nuclear astrophysics.

Instruments currently in design include the following.

Neutron Powder Diffractometer Upgrade (FP 1). A newly funded upgrade to the Neutron Powder Diffractometer (NPD) is currently under way with an expected completion date of 2002. This project is funded by the National Science Foundation and involves a collaboration including the University of Pennsylvania, State University of New York at Stony Brook, University of Virginia, Michigan State University, University of California, Santa Barbara, and Los Alamos National Laboratory. The upgrade includes expanded detector coverage at the backscattering angle with the objective of increased data acquisition rate at high-Q for determination of pair distribution functions (PDF) with high real-space resolution.

IN500 (FP 13). The goal of this project is the development of an advanced prototype spectrometer for inelastic cold-neutron scattering spectroscopy on pulsed spallation sources. This project will allow spallation sources to compete with the leading reactor facilities in this crucial area of neutron research. In 1999, the physical design of the beam-delivery system was completed based on the novel concepts of reduced loss ballistic neutron guide and disc-chopper system with repetition-rate capability. Engineering design is in progress for the installation of a beam shutter on FP 13 together with the in-pile neutron-optical beam-extraction system and an integrated shielding around the beam shutters of FP 12 and 13. The project is funded by LDRD (institutional funds) for FY1999-2003. Monte Carlo simulations are being conducted in support of the pre-engineering design, which include the sample area/detector system, spectrometer shielding systems, and further performance evaluations. Installation is expected to begin in January 2002.

Silicon Analyzer Backscattering Spectrometer (allocated FP 11B). The Silicon Analyzer Back-scattering Spectrometer (SABER) will be used for quasi-elastic and inelastic neutron scattering studies of the dynamics of condensed matter systems. A white beam diffraction bank will allow simultaneous studies of the structure and dynamics. SABER will be used for studies of physical phenomena such as: atomic and molecular diffusion in zeolites, polymers, biomaterials, tunneling in molecular systems magnetic excitations, phonons and protons in quantum liquids. SABER operates on the same principle as the IRIS spectrometer at ISIS. However, the use of silicon for the energy analyzers leads to higher energy resolution, allowing longer time scales and larger distance scales to be studied, and lower instrumental backgrounds. SABER will be the first spallation source instrument employing silicon for energy analysis. A detailed installation schedule is in preparation and work will begin in 2001.

Variable Energy and Resolution for Thermal Excitations (allocated FP 14). The Variable Energy and Resolution for Thermal Excitations (VERTEX) instrument is a modification of the proposal for the High Intensity Chopper Spectrometer HELIOS. The Spectrometer Development Team considered and supported a proposal to build VERTEX by upgrading PHAROS, adding a guide, and moving the chopper spectrometer to a coupled-water-moderator flight path. VERTEX is a high-intensity, direct-geometry, time-of-flight spectrometer. VERTEX will be optimized to provide the highest possible neutron flux at the sample, high detection efficiency, and sufficient energy resolution to study dynamical processes in a wide variety of materials. The spectrometer will use the full energy spectrum of neutrons provided by the coupled water moderator that serves FP 14. It is anticipated that VERTEX will be effective for studies of excitations from a few milli-eV to several hundred milli-eV. The VERTEX SDT has strong participation and support from the Spallation Neutron Source (SNS) project at Oak Ridge National Laboratory, the California Institute of Technology, and from Johns Hopkins University. Installation is anticipated to begin January 2002.

Cold Neutron Fundamental Nuclear Physics (FP 12). The world's most intense pulsed-cold-neutron-beam, FP 12 will be used for a fundamental nuclear physics effort to precisely measure the asymmetry of the emission of gamma rays from the capture of polarized neutrons by protons, for a search for a neutron electric dipole moment, and for studies of neutron beta decay. The anticipated installation start is January 2002.

3 Support Facilities

3.A Available Support Facilities

- A rotating anode x-ray machine is outfitted with a strain goniometer and a reflectivity capability. Standard diffraction patterns can also be taken.
- A wet chemistry laboratory with two hoods is available for sample preparation, particularly those that require acids or bases.
- A materials laboratory is available that has a hood for solvent use only, weighing balances, an inert-atmosphere glove box, and a 1200°C furnace.
- Evaporation capability for the preparation of thin metallic films.
- A class 100,000 clean room for sample preparation, including a Langmuir-Blodgett trough and a hood.
- A number of computers (multiplatform) are available at the Lujan Center for data analysis, as well as black and white/color printers and internet connection.
- Other facilities are available at the Laboratory, though not necessarily at LANSCE, such as biology laboratories.

3.B Planned Support Facilities

A future office/laboratory building, currently in the planning stage, will increase laboratory space and provide new facilities not yet available, such as an area for the preparation of samples for the protein crystallography station, improved chemistry lab facilities, a cryogenics lab, and a magnet lab.

4 Staff

4.A Size of Staff and Their Assignments

4.A.1 Accelerator Staff

Of the current 91 staff directly involved in accelerator and Lujan target operations and support, approximately 33% are considered professional staff supported by approximately 66% technicians.

Accelerator Controls	5	Power Supplies	3.9
Accelerator Physics	4.3	Pulse Power	1.8
Beam Diagnostics	3	Reliability	2
Beam Delivery	18	RF	11.3
Electronics	4.6	Vacuum	3.8
Machine Interlocks	3.8	Water	1.8
Mechanical	7.1	Target	17.5
Injectors	2.9		

4.A.2 Scientific Staff at Lujan

The scientific staff (43) at the Lujan Center consists of LANSCE-12 employees, employees of other Los Alamos organizations, consultants and other visitors, postdoctoral appointees, and students. Currently, there are 13 LANSCE-12 scientific staff members, 16 staff from other Los Alamos technical organizations, 2 consultants, 8 postdoctoral appointees, and 4 graduate students. Other than the graduate students, all scientific staff members have received a Ph.D. Of the 13 LANSCE-12 staff, 11 are directly involved in the neutron scattering user program, including such roles as instrument scientist and principal investigator, or program manager of a new spectrometer (VERTEX or SABER) or major piece of sample environment equipment (e.g., 30-T magnet). Two of the Ph.D. staff work in spallation physics studies for target/moderator systems and beam shielding. Of the 16 staff from other Los Alamos organizations, 7 are involved in user activities and the others are strongly involved in the neutron scattering program. The two consultants are currently directly involved with the development of new high-pressure capabilities for neutron scattering and on the development of SMARTS and the strain program. The eight postdoctoral appointees assist the Lujan Center users and conduct a scientific research program. Graduate students are all working on a Ph.D. thesis project involving neutron scattering and are associated with an academic institution. Physics Division staff involved with the two nuclear physics beam lines located at the Lujan Center are not included in this breakdown.

4.A.3 Technician Staff at Lujan

Mechanical Technicians (5): There are currently five technicians, with one more to be hired shortly. One technician acts as supervisor and instrument technician for one neutron scattering instrument. Each of the remaining technicians in general is responsible for two neutron scattering spectrometers. In addition, technicians are responsible for forklifts, cranes, mercury shutter systems, and various other tasks as required.

Electrical/Computer Technicians (4): There is one supervisory technician who also works on computer systems and detector electronics. One technician is occupied full-time on computer systems and networks. Two additional electrical technicians work on chopper and detector systems and other electrical equipment such as furnaces, helium refrigerators, etc.

Designers (4): Currently, there are four designers, one of which is the supervisor. Designers are currently involved in the design of the new neutron scattering spectrometers, sample environment equipment, or accessories.

4.A.4 Computer Staff at Lujan

The computer and electrical engineering staff (7) are combined under one team leader. There are two electrical engineers responsible for chopper and detector systems and other electrical apparatus required to operate the spectrometers. There is one computer-systems manager responsible for maintaining the data acquisition systems and to assist with desktop and laptop systems. Three employees are working on data acquisition software maintenance and development of new data acquisition software.

4.A.5 Additional Staff

A number of other personnel (9) are supported to ensure the success of the user program. A safety officer is responsible for working with the staff and users to maintain a safe environment in the areas of ALARA, OSHA, waste management, and radiation safety. There are two group administrators to support LANSCE-12 staff and also provide some day-to-day support to on-site users. There is one instrument assistant currently supporting the HIPD special user program. Instrument assistants are expected to tend to the day-to-day needs of the users and maintain the neutron scattering spectrometer and associated sample environment equipment in a state of readiness. One mechanical engineer provides analysis of engineering structures and works with the designers, instrument scientists, and mechanical technicians on the new spectrometers and spectrometer upgrades. The intent is to hire an additional mechanical engineer in the near future. The Lujan Center is also supporting one high school co-op student in the administrative section, one high school co-op student in the design section, and two undergraduate students working in the computer/electronics section.

Two management positions, Group Leader and Deputy, are occupied by Ph.D. scientists with research experience at neutron and synchrotron facilities. The group management ensures that the Lujan Center is operated safely, that the resources are allocated where most needed, and interface with the target/moderator and beam delivery teams.

In addition to Lujan Center staff, the User Coordination Office consists of 2.5 administrative support personnel working under LANSCE-4 (Communication and User Coordination). The User Program

Coordinator is responsible for establishing and implementing streamlined processes to facilitate the proposal process, user access and training, statistical data analysis and reporting, user communications via various media, and responding to user queries and concerns. The database administrator is responsible for statistical data collection and entry, reporting, database development, and user web page maintenance. A receptionist/administrative person spends approximately 50% time on direct user support, including preparing user check-in packages, data entry, issuing badges, and maintaining tourist and visitor information for users.

4.B Quality of the Staff

The educational breakdown for the current staff supporting accelerator and Lujan target operations is the following: 18% Ph.D., 5% MS, 12% BS, 17% Associate Degrees, 10% students, and 4% contract labor. The remaining employees do not have formal degrees; their experience level ranges from 2–33 years.

The educational breakdown of current Lujan Center staff is as follows:

LANSCE-12 (Lujan Center)	Number of Staff	Education Level	Experience
Scientific Staff	39	39 Ph.D.	2-30+ years
Computer/Electronics Systems Staff	5	2 Ph.D., 3 BS	5-20+ years
Electronics/Computer Technicians	4	1 AA	5-20+ years
Mechanical Technicians	5		3 months-20+ years
Electrical Engineers	2	2 MS	5-15 years
Mechanical Engineer/ Design	5	1 BE	15 years
Instrument Assistant	1	1 BS	10 years
Students	7	3 GRA, 2 UGS, 2 HS Co-op	N/A
Other Staff	4	Management-2 Ph.D. Administration	20+ years 5-20+ years

Following is a partial list of awards, honors, elections to professional organizations, professional memberships, participation on external technical advisory committees, and professorships held by LANSCE staff in the accelerator groups and the Lujan Center scientific, technician, and computing staff over the past two years. Management staff and other LANSCE staff not directly related to the Lujan Center or accelerator operations are not included in these lists. Data from previous years are available upon request.

Staff Awards, Honors, and Elections to National Science/Engineering Societies

Bennett, K., Fellow of the Institute of Geophysics and Planetary Physics
Bordallo, H., Los Alamos Achievement Program Award
Callaway, T., ES&H Worker Recognition
Cummings, K., John Dorn Outstanding Graduate Student Award, Golden Gate Chapter of ASM International
Cushing, S., Los Alamos Achievement Program Award
Daemen, L., 2000 DOE Pollution Prevention Award
DeBaca, I., Los Alamos Achievement Program Award
Espinoza, E., Certificate of Appreciation
Garnett, R., nominated to the Science and Engineering Advisory Council (SEAC)
Geelan, M.P., (1) Los Alamos Achievement Award; (2) 1999 Pollution Prevention Award
Hannaford, J., 1999 Pollution Prevention Award
Herrera, J., 1999 Pollution Prevention Award
Lation, J., Los Alamos Achievement Program Award
Ledford, J., Los Alamos Distinguished Performance Award
Lopez, L., Los Alamos Achievement Program Award
Lovato, J., Certificate of Appreciation
Lovell, K., Los Alamos Achievement Award
Lusk, M., Certificate of Appreciation
Madrid, M., Los Alamos Achievement Program Award

Manzanares, C., Certificate of Appreciation
Mezei, F., (1) Inaugural Walter Haelg Award of the European Neutron Scattering Association (NSE) for being the most outstanding contributor to the progress in neutron scattering science in Europe in the past 3 decades; (2) Inaugural Eugene P. Wigner Award of the Hungarian Government and the Hungarian Academy of Sciences for the most outstanding contribution to physics achieved by a native Hungarian working abroad
Midkiff, B., invited to teach the following courses: Water chemistry training seminars at Chicago and Philadelphia for Association of Water Technologies, and Water Chemistry Training Seminar, Saudi Arabia Center for Professional Advancement
Morgan, S., 1999 Pollution Prevention Award
Neri, F., Award for Excellence for Nuclear Weapons
Olivas, D., Los Alamos Achievement Program Award
Olivas, F., Los Alamos Achievement Program Award
Olivas, P., 1999 Distinguished Perfomance Award
Ostrem, D., Los Alamos Achievement Program Award
Pitcher, E., Member of the Employee Advisory Council
Robinson, R., Fellow, American Physical Society
Russina, M., (1) ECNS '99 Young Scientists Award; (2) PhD-Preis (Promotionspreis) of Hahn-Meitner-Institite Berlin
Schaller, S., nominated to the Science and Engineering Advisory Council (SEAC)
Shelley, F., Los Alamos Achievement Program Award
Smith, G., 2000 LANSCE Director's Award for Scientific Excellence
Stinson, C., ES&H Worker Recognition
Von Dreele, R., (1) 1999 Distinguished Performance Award; (2) elected to the Crystallographic Data and Computing Committee of the American Crystallographic Association; (3) elected to International Committee for Diffraction Data (ICDD)
Winton, W., Los Alamos Achievement Program Award

Memberships in Professional Organizations
Advanced Computing Systems Association (USENIX): G. Carr
American Association for Advancement of Science: J. Eckert, R.P. Hjelm, R. McQueeney, M. Oothoudt, R.A. Robinson, J.L. Smith, F. Trouw
American Ceramic Society: J.L. Smith
American Chemical Society: J. Eckert, F. Trouw
American Crystallographic Association: R. Robinson, G. Smith, R. Von Dreele
American Geophysical Union: R.B. Von Dreele
American Nuclear Society: P.D. Ferguson, G.J. Russell, J. Donahue
American Physical Society: G. M. Bendele, D.W. Brown, J.S. Bull, S. Cohen, L.L. Daemen, J. Donahue, J. Eckert, J. Faucett, R. Garnett, D. Gurd, R. Hjelm, A. Hoffmann, W. Ingalls, J. Jarmer, K.W. Jones, T. Kozlowski, W. Lysenko, R. McQueeney, F. Mezei, M. Oothoudt, M. Plum, R.A. Robinson, L. Rybarcyk, S. Schaller, J. Sherman, G.S. Smith, J.L. Smith, F. Trouw, C. Wilkinson
American Society for Metals – ASM International: J.L. Smith, R. Brown, P. Rangaswamy
American Society for Nondestructive Testing: W. Boedeker
American Society for Quality: J. Faucett
American Society of Mechanical Engineers: K. Cummings, P. Rangaswamy
American Vacuum Society: W. Boedeker
American Water Works Association: W. Midkiff
Association for Computing Machinery: T. Kozlowski, E. Bjorklund, G. Carr, S. Schaller, M. Zumbro
Association of Water Technologies: W. Midkiff
Commission on Powder Diffraction of the International Union for Crystallography: R.B. Von Dreele, United States Representative (1999-2002)
Cooling Tower Institute: W. Midkiff
Deutsche Physikalische Gesellschaft (German Physical Society): A. Hoffmann, T. Spickermann
Eta Kappa Nu: C. Rose
European Academy of Sciences (Academia Europaea): F. Mezei
European Physical Society: F. Mezei
Health Physics Society: J.S. Bull
Hungarian Academy of Sciences: F. Mezei
Institute of Electrical and Electronic Engineers: E. Jacobson, T. Kozlowski, A. Kozubal, P. Lewis, M. Lynch, M.Oothoudt
International Center for Diffraction Data: R.B. Von Dreele
Materials Research Society: L.L. Daemen, R.P. Hjelm, R. Pynn, G. Smith, J.L. Smith
Mathematical Association of America: E. Bjorklund, R. Wright

Mineralogical Society of America: R.B. Von Dreele
New Mexico Women in Science and Engineering: K. Bennett, Secretary for the State Organization Committee
Professional Society of Engineers: C. Rose
Registered Mechanical Engineers: R. Wood (CA)
Science and Engineering Advisory Council: R.W. Garnett, S. Schaller
Sigma Pi Sigma: J. Knudson, R. Macek
Sigma Xi: E. Gray, J. Knudson, R. Macek
Society of Women Engineers: K. Cummings
System Administrators Guild (SAGE): G. Carr
Tau Beta Pi: C. Rose, R. Stevens
The Minerals, Metals, and Materials Society–TMS: J.L. Smith
Water Environment Federation: W. Midkiff

Membership on External Technical Advisory Committees

Bourke, M.: (1) IPNS Experiment Proposal Evaluation Committee (diffraction); (2) Engineering Applications Working Group at SNS; (3) VAMAS International Standards Working Group on Neutron Diffraction Residual Stress Measurements; (4) Versailles Agreement on Advanced Materials and Standards initiative for establishing neutron strain standards
Daemen, L.L.: reviewer for the International Science and Technology Center Projects
Eckert, J.: (1) member of the Instrument Advisory Committee for Backscattering Spectrometer at SNS; (2) IPNS Proposal Advisory Committee; (3) Subcommittee on Chemistry of the Neutron Society of America
Hjelm, R.P.: (1) Executive Committee, Instrument Advisory Team for Small-angle Scattering, SNS; (2) Large Scale Structures Working Group; (3) Program Committee Member of the XI International Conference on Small-angle Scattering
Kozlowski, T.: (1) chairman, IEEE NPSS Computer Applications in Nuclear and Plasma Sciences Technical Committee; (2) chairman, 1999 IEEE NPSS Real-Time Conference
Majewski, J.: NIST Center for Neutron Research (NCNR) Proposal Review Committee
McQueeney, R.: (1) visiting scientist, California Institute of Technology; (2) member of the Spallation Neutron Source High Flux Isotope Reactor User Group Executive Committee; (3) Lattice Excitations Work Group at Spallation Neutron Source Workshop on Inelastic Neutron Scattering
Mezei, F.: (1) SNS Instrument Oversight Committee; (2) Scientific Council of Laboratoire Leon Brillouin, Saclay, France; (3) Institut-Laue-Langevin Instrumentation Subcommittee; (4) Scientific Council of Institut-Laue-Langevin
Oothoudt, M.: Audit Committee for the Control System of the Paul Scherrer Institute Proton Accelerator
Russell, G.: Target/Instrumentation Advisory Committee (TIAC) for the Oak Ridge Spallation Neutron Source (SNS) project
Smith, G.: (1) Secretary, Proposal Evaluation Committee for Spectrometer Development Project; (2) Advanced Photon Source CMC CAT Executive Committee; (3) IPNS Experiment Proposal Evaluation Committee (SANS and Reflectometry); (4) Target/Instrumentation Advisory Committee (TIAC) for the SNS
Smith, J.L.: (1) Proposal Review Panel, National High Magnetic Field Laboratory; (2) Brown University Alumni Association Board of Governors; (3) Selection Committee for Chair of Experimental Condensed-Matter Physics
Trouw, F.: (1) IPNS Experiment Proposal Evaluation Committee (Inelastic Scattering); (2) Chemistry Working Group at SNS; (3) chair, Chemical Excitations Working Group at the SNS Workshop on Inelastic Neutron Scattering
Von Dreele, R.: (1) Powder Diffraction Working Group at SNS; (2) member of the Liquids and Amorphous Materials Working Group at SNS; (3) Chairman of the Neutron Scattering Special Interest Group, American Crystallographic Association; (4) Chair of newly formed International Committee for Diffraction Data Subcommittee for Neutron Powder Diffraction

Membership on Editorial Advisory Boards for Professional Journals

Mezei, F.: editorial board of Journal of Neutron Research
Robinson, R.: editorial board of Journal of Neutron Research
Smith, J.L.: (1) editorial board, Journal of Alloys and Compounds; (2) editor of Philosophical Magazine B

Professorships

Cohen, S.: Adjunct Professor of Physics, UNM Department of Physics and Astronomy
Eckert, J.: Adjunct Professor, Department of Chemistry, Texas A&M University
Eckert, J.: Adjunct Professor of Physics, University of Nevada at Las Vegas
Hjelm, R.P.: Adjunct Professor, University of Illinois 1995-
Nakotte, H.: Joint New Mexico State University and LANSCE Professor
Robinson, R.: (1) Adjunct Professor at University of California Riverside, 1998-1999; (2) Adjunct Professor, New Mexico State University, 1993-1999
Smith, J.L.: (1) Adjunct Professor of Physics, Florida State University, Tallahassee, 1991-; (2) Adjunct Professor of Physics, Boston College, Boston, 1997-; (3) Adjunct Professor of Chemistry, Brigham Young University, 1999-

Following is a partial list of invited presentations by LANSCE staff in the accelerator groups and the Lujan Center over the past two years. This list is incomplete because most authors do not identify each talk as contributed or invited when they provide the information during the annual publications call (although it is requested). There are approximately 150 additional talk entries in the database since 1998 that are not included in the list below as we are unable to ascertain whether the talk was invited or contributed. Some additional data from previous years is available upon request.

Argyriou, D.N., Von Dreele, R., Cation Disorder and Vacancy Distribution in Non-Stoichiometric Magnesium Aluminate Spinel MgO.xAl2O3, Presented at the 100th Meeting of the American Ceramics Society, Cincinnati, OH, May (1998)
Bordallo, H.N., Effects of Hydrogen Absorption in TbNiAl and uNiAl, Presented at the Intense Pulsed Neutron Source, Argonne National Laboratory, Argonne, IL, May 18 (1998)
Bordallo, H.N., Study by Raman Spectroscopy of the CMR: La(sub 2-2x)Sr(sub 1+2x8)Mn(sub 2)O(sub 7), Presented at the XXI Encontro Nacional de Fis ica da Materia Condensada, Caxambu, Brazil (1998)
Brown, D.W., Bourke, M., "Applications of Rietveld Refinement to Engineering Problems," 48th Denver X-Ray Conference, Steamboat Springs, CO, August 2–6, 1999.
Daemen, L.L., "Monte Carlo Tool for Neutron Optics and Neutron Scattering Instrument Design," 44th Annual SPIE Meeting, Denver, CO, July 19–23, 1999.
Fitzgerald, D.H., "Proton Storage Ring Injection Upgrade," ICFA Mini-Workshop on Injection and Extraction in High-Intensity Proton Machines, Abingdon, UK, February 23–26, 1999.
Goetz M.B., Instructor at the US Particle Accelerator School
Hjelm, R.P. Calibration and Assessment of Small-Angle Neutron Scattering Data, Presented at the Workshop on Small-Angle Data Analysis and Data Exchange, Grenoble, France, February 4-7 (1998)
Hjelm, R.P. Gerspacher, M., Yang, H-H., Hawley, M.E., Lindner, P., Carbon Black Structure and Associations in Filled Rubber: A Small-Angle Neutron Scattering Study, Presented at the World Wide Amazon Rubber Conference, Manous, Brazil, October 31 - November 4 (1999)
Hjelm, R.P. Mang, J.T., Vesicle Stability in Bile Salt Phosphatidylcholine Mixed Colloids: Pressure and Temperature Probes, Presented at the Colloids Topical Meeting, American Chemical Society, Pennsylvania State University, June 22- 27 (1998)
Hjelm, R.P. Polymers and Filler Structure and Interactions: Neutron Scattering and Reflectometry as Experimental Probes into the Structure Function Relationships of Reinforced Polymers, Presented at the American Chemical Association Symposium on Advanced Materials Testing, Orlando, FL, September 21-24 (1999)
Hjelm, R.P. Studies of Composite Material Structure Using New Methods of Neutron Scattering, Presented at the ISMANS University, LeMans, France, February 9 (1998)
Hjelm, R.P., Carbon Black and Polymer Structure and Associations in Filled Rubber by Small-Angle Neutron Scattering Study, Invited talk ACS Round Table Discussion on Composite Elastomers, April 2000
Hjelm, R.P., Mang, J.T., Skidmore, C.B., Howe, P.M., Characterization of Structure and Defects in High-Explosives Using Small Angle Neutron Scattering, Presented at the 6th International Meeting on Applications of Nuclear Techniques, Crete, Greece, June 20-26 (1999)
Hoffmann, A., "Artificially Induced Reconfiguration of the Vortex Lattice in Nb," Superlattice and Microstructure Workshop, Cancun, Mexico, August 27–29, 1999.
Hoffmann, A., "Periodic Pinning with Magnetic Dots: Does the Size and Geometry Matter?" 1999 Centennial Meeting of The American Physical Society, Atlanta, Georgia, March 20–26, 1999.
Krawczyk, F., "Status of LANL Activities in RF Superconductivity," 9th Workshop on RF Superconductivity, Santa Fe, NM, November 1999
Lawson, A. C., Crystallography and Lattice Anharmonicity in Pu, 1998 SRG Workshop on Plutonium, Center for Materials Science, Los Alamos National Laboratory, Aug 17-18, 1998
Lawson, A.C., Anomalous Scattering by Self-intermetallic compounds, and Structural Disorder in the Diffraction Background, Presented at the Workshop on Practical Aspects of X-ray Powder Diffraction, Stanford Synchrotron Radiation Laboratory, Stanford University, October 21, 1998.
Lawson, A.C., Crystallography and Lattice Anharmonicity in Pu, 1998 SRG Workshop on Plutonium, Center for Materials Science, Los Alamos National Laboratory, Aug 17-18, 1998
Lawson, A.C., Neutron Diffraction and the Physical Properties of the Light Actinides, Presented at the American Nuclear Society, Washington, D.C., November 16, 1998
Lawson, A.C., Roberts, J.A., Bennett, B.I., Brun, T.O., Von Dreele, R.B., Richardson, J.W., Lattice Effects in the Light Actinides, Presented at Conference on Electron Correlation and Materials Properties, Crete, Greece, June 28-July 3, 1998
Lawson, A.C., Roberts, J.A., Bennett, B.I., Neutron Diffraction and the Physical Properties of the Light Actinides, Presented at the American Nuclear Society, Washington, D.C., November 16, 1998

Lawson, A.C., Structural Disorder and Diffuse Scattering In TOF Neutron Diffraction Patterns, Presented at the Workshop in New Techniques for Studying Short Range Atomic Order in Crystalline Solids, Center for Materials Science, Los Alamos National Laboratory, November 2-4, 1998

Lawson, A.C., Von Dreele, R.B., Cort, B., Roberts, J.A., Richardson, J.W., Rietveld Refinement of Diffuse Scattering in Neutron Powder Diffraction Data, American Crystallographic Association, Buffalo, NY, May 27, 1999

Lawson, A.C., Von Dreele, R.B., Rietveld Refinement of Diffuse Scattering in Neutron Powder Diffraction Data, American Crystallographic Association, Buffalo, NY, May 27, 1999

Majewski, J.P., A Model Study of Tethered Chains Using Langmuir Monolayers of Diblock Copolymers, 218th ACS Annual Meeting, New Orleans, Aug. 22-26, 1999

Majewski, J.P., Neutron Scattering Studies on Membrane-Polymer Composites, Presented at the Max Planck Institute for Polymer Studies, Mainz, Germany, February 25 (1998)

Majewski, J.P., Smith, G.S., Polymer Brushes at the Air-Liquid Interface Studied by Neutron Reflection and Surface Tension Measurements, XVIIIth IUCR (International Union of Crystallography) Congress and General Assembly, Glasgow, Scotland, Aug 4-13, 1999

Mcqueeney, R.J., Inelastic Neutron Scattering from Cerium, Presented at New Mexico State University, September 18 (1998)

Merl, R., "The Effect of Charge State on Fullerene Polymerization," 1999 Centennial Meeting of the American Physical Society, Atlanta, Georgia, March 20–26, 1999.

Mezei, F., "What Neutrons Do Tell Us About the Nature of (Spin) Glasses," ECNS '99, Budapest, Hungary.

Plum, M., "Electrons in the PSR," LANSCE Short Pulse Spallation Source Buncher II TiN Workshop, Los Alamos, NM, May 17–18,1999.

Plum, M., "Experimental status of the PSR instability," LANSCE Short Pulse Spallation Source Buncher II Replanning / PSR Instability Workshop, Los Alamos, NM, January 19–20 1999.

Plum, M., "Status of the PSR Inductor," LANSCE Short Pulse Spallation Source Buncher II Replanning / PSR Instability Workshop, Los Alamos, NM, January 19–20, 1999.

Plum, M., "Status of the SREX Line," LANSCE Short Pulse Spallation Source Buncher II Replanning /PSR Instability Workshop, Los Alamos, NM, January 19–20, 1999.

Rangaswamy, P., Experimental Confirmation Of Finite Element Methods To Determine Residual Stresses In Metal Matrix Composites, The United New Generation Vehicle Conference and Exposition- Advanced Composites with Advanced Coatings Technology and Environmental Vehicles, 1998

Robinson, R.A., Prospects for Performing Neutron Scattering in Intense Pulsed Magnetic Fields, Presented at the 44th Annual Conference on Magnetism and Magnetic Materials, San Jose, CA, November 15-18 (1999)

Russina, M., "Beam Extraction and Low Losses Guides," Workshop NOP, Villigen, Switzerland, November 25–27, 1999.

Spickermann, T., "The Antiproton Decelerator Project," Los Alamos Neutron Science Center, Los Alamos, NM, May 1999.

Sterbenz, S.M., Stockpile Stewardship at LANSCE, Presented at the Duke University Physics Department, Invited Lecture Series, May (1998)

Wangler , T.P., "APT Linac Design for Low Beam Loss," 7th ICFA Mini-Workshop on High Intensity High Brightness Beams—Beam Halo and Scraping, Lake Como, WI, September 13–15, 1999.

Von Dreele, R.B., Rietveld Refinement with Energy Dispersive Powder Diffraction Data, Presented at the NSLS Users Meeting, Brookhaven, NY, May 18-20 (1998)

Wangler, T.P., "Beam Halo Formation in High Intensity Proton Beams," 2nd ICFA Advanced Accelerator Workshop on the Physics of High Brightness Beams, UCLA, November 9–12, 1999.

Wangler, T.P., Crandall, K.R., Kelley, J.P., Krawczyk, F., Schrage, D.L., "Design of a Proton Superconducting Linac for a Neutron Spallation Source," 9th Workshop on RF Superconductivity, Santa Fe, NM, November 1–5, 1999.

Zhao, Y., Clinopyroxene Structure at High P-T Conditions and Implications to Mantle Modeling, Presented at the Bayerisches Geoinstitute, Universitat Bayreuth, July 14 (1998)

Zhao, Y., Getting, I.C., Von Dreele, R.B., TAP-98: A New Design of Toroidal Anvil Press for High P-T Neutron Diffraction, Presented at the International Union of Crystallography (IUCr) High-Pressure Conference at APS/ANL, Chicago, IL, November 14-17 (1998)

Zhao, Y., Pressure, Temperature, and Composition Effects on Perovskite Structure and Phase Transition, Presented at the Physics Department, New Mexico State University, Las Cruces, NM, February (1998)

5 Users

5.A Quality of Users

5.A.1 Publications and Citations

The top 20 publications resulting from research conducted at the Lujan Center since 1995 can be categorized in the following discipline areas: 13 in materials, 6 in chemistry, and 1 in physics. These publications have been cited a total of at least 445 times as of October 31, 2000. However, papers based on data taken during the 1997 run are just now beginning to appear in journals. Therefore, although some of the current citation numbers appear low for the more recent papers considered to be the Lujan's "top 20," it is anticipated that these publications will have high impact in their field. These publications range in impact factor, as per the Journal of Citation Reports, from 6.017 to 0.993. The publications are listed in Section 6.A, Top 20 Papers.

5.A.2 Awards by Users

LANSCE does not regularly collect data from users regarding awards. A call for this information was issued on October 25, 2000, in order to respond to the BESAC Panel's request. The limited number of users that were able to respond in the time allowed reported the following partial data. (Awards for staff are shown in Section 4.B, Quality of Staff.)

Cady, S., Portland State University, Appointed Editor in Chief of the new Astrobiology Journal, 2000
Chaudret, B., CNRS, Silver Medal of the CNRS France, 1998
Dunand, D., Northwestern University, Board of Review, *Metallurgical and Materials Transactions A*, 1/98-present
Dunand, D., Northwestern University, Editorial Committee (USA Representative), *Revue de Métallurgie*, 3/98-present
Dunand, D., Northwestern University, Invited Speaker for the Annual *Sauveur Lecture* (Boston ASM Chapter), 1996
Dunand, D., Northwestern University, *Teacher of the Year*, Department of Materials Science and Engineering (NWU), 1998
Dunand, D., Northwestern University, Visiting Faculty at the Institute of Metallurgy of Stuttgart University, 1999
Dunand, D., Northwestern University, Visiting Professor at the Department of Materials, Swiss Federal Institute of Technology, Lausanne, Switzerland, 2000
Dunand, D., Northwestern University, Visiting Scholar at the National Research Institute of Metals (Tsukuba, Japan), 2000
Graham, A., LANL, The Vice-President's Award for Technical Accomplishments and Outstanding Contributions to the Partnership for a New Generation of Vehicles, 1997
Green, H., II, University of California– Riverside, Abelson Lecturer, Carnegie Institution of Washington, DC, 2000
Green, H., II, University of California– Riverside, Appointed Honorary member of the faculty, China University of Geosciences, Wuhan, 1998
Green, H., II, University of California– Riverside, Biography included in Who's Who in Science and Engineering, 1996-
Green, H., II, University of California– Riverside, Elected Fellow of the American Geophysical Union, 1995
Green, H., II, University of California– Riverside, Elected Fellow of the American Association for the Advancement of Science (AAAS), 1996
Green, H., II, University of California– Riverside, Elected to membership in the Cosmos Club of Washington, DC, 1999
Green, H., II, University of California– Riverside, Francis Birch Lectureship of the Tectonophysics Section of the American Geophysical Union: "The Anticrack Mechanism of High Pressure Faulting and Deep-Focus Earthquakes," 1995
Green, H., II, University of California– Riverside, Profiled in *Great Scientific Achievements of the 20th Century* for "solving the mystery of deep earthquakes" (with former student PC Burnley - approximately 400 profiles total for all sciences), 1997
Green, H., II, University of California– Riverside, Promoted to "distinguished professor," University of California, 1999
Hellman, F., University of California – San Diego, Elected Chair of Division of Materials Physics of APS, 1999-2000
Hellman, F., University of California – San Diego, Fellow of the American Physical Society, 1997
Israelachvili, J., Elected Foreign Associate of the US National Academy of Engineering, 1996
Kuhl, T., University of California – Santa Barbara (now at Davis), Presidential Early Career Award from National Science and Technology Council, 1998
Kuhl, T., University of California – Santa Barbara, Early Career Award for Scientists and Engineers by DOE, 1998
Lee, K.Y., University of Chicago, 1999 "40 Under 40" Award, Crain's Chicago Business
Lee, K.Y., University of Chicago, 1999 Ruth Salta Junior Investigator Achievement Award in Alzheimer's Disease Research
Lee, K.Y., University of Chicago, Basil O'Connor Starter Scholar Research Award, 1999
Lee, K.Y., University of Chicago, National Research Service Award, Individual Postdoctoral Fellowship, 1997
Lee, K.Y., University of Chicago, National Research Service Award, Individual Postdoctoral Fellowship, 1995
Lee, K.Y., University of Chicago, New Faculty Award, Camille and Henry Dreyfus Foundation, 1998
Lee, K.Y., University of Chicago, Packard Fellow for Science and Engineering, 1999
Lee, K.Y., University of Chicago, President's Postdoctoral Fellowship, University of Californi, 1995
Lee, K.Y., University of Chicago, Searle Scholar Award, 1999
Lee, K.Y., University of Chicago, Wallace Prize Fellowship, Harvard Univerisity, 1990
Limbach, H.H Free University of Berlin, Vice-Chairman 2000 and Chairman 2002 of the Gordon Conference on Isotopes in the Biological and Chemical Sciences
Limbach, H.H., Free University of Berlin, El Huyar - Goldschmidt Lecture of the German and Spanish Chemical
Limbach, H.H., Free University of Berlin, Professor Honoris Causa of Physics, State University of St. Petersburg

Lobo, R., University of Delaware, Camille Dreyfus Teacher-Scholar Award, 1999
Lobo, R., University of Delaware, CAREER Award for Young Investigators of the NSF, 1997
Lobo, R., University of Delaware, Francis Allyson Society Young Scholar Award, 1999
Lobo, R., University of Delaware, Outstanding Young Faculty of the College of Engineering, 1999
Mayes, A.M., Massachusetts Institute of Technology, APS DHPP Dillion Medal for Polymer Physics, 1999
Mayes, A.M., Massachusetts Institute of Technology, GenCorp Signature University Award, 1999
Mayes, A.M., Massachusetts Institute of Technology, MRS Outstanding Young Investigator Award, 1998
Mitchell, J., ANL, DOE Early Career Award and Presidential Early Career Award for Scientists and Engineers, 2000
Mitchell, T., Los Alamos National Laboratory, Fellow of the Minerals, Metals and Materials Society, 1996
Mitchell, T., Los Alamos National Laboratory, Honored with 60th Birthday Symposium and Special Issue of Philosophical Magazine A (Sept. 1998)
Mitchell, T., Los Alamos National Laboratory, Japan Society for the Promotion of Science, Fellowship, 1997
Pentilla, S., Los Alamos National Laboratory, Fellow of the American Physical Society, 1999
Ruzette, A.-V.G., Massachusetts Institute of Technology, 1999 MRS Graduate Student Award -- Silver
Ruzette, A.-V.G., Massachusetts Institute of Technology, Belgian-American Foundation Fellowship, 1998
Ruzette, A.-V.G., Massachusetts Institute of Technology, Chateaubriand Postdoctoral Fellowship, 2000
Ruzette, A.-V.G., Massachusetts Institute of Technology, IBM Graduate Fellowship, 1999
Sass, S.L., Cornell University, Fellow, ASM, 1997
Vaidyanathan, R., MIT, Louie Rosen Prize for Best Thesis Based on Work Done at LANSCE, 2000
Vogel, S., Kiel University, Jerome B. Cohen Award from the International Center for X-ray Diffraction Data (work was based on research done at Lujan on NPD)
Wong, J., Boston University, Clare Boothe Luce Chaired Assistant Professorship, 1998-2002
Wong, J., Boston University, NSF Career Award, 2000

5.B Summary of Outside User Support

The following table summarizes information collected from all proposals from 1995-1997. Information is not requested at a detailed level; users provided us with the associated funding agencies of each proposal, which are most often multiple agencies. The graphic depicts the average over 1995-1997, by agency, over all Lujan Center instruments.

	HIPD	FDS	LQD	SCD	NPD	PHAROS	SPEAR
Academia	6%	23%	42%		11%	5%	3%
DoD					7%		3%
DOE/BES	33%	23%	17%	56%	43%	48%	52%
DOE/DP	37%		13%		32%	10%	15%
DOE/Other	24%	8%		11%	4%		12%
Foreign	4%	15%	21%	33%		24%	18%
Industry	6%	15%	13%				6%
NASA	2%				4%		
NIH			4%		4%		12%
NSF	12%	15%	13%	11%	14%	38%	33%
Other	10%	8%	4%	33%	18%	10%	

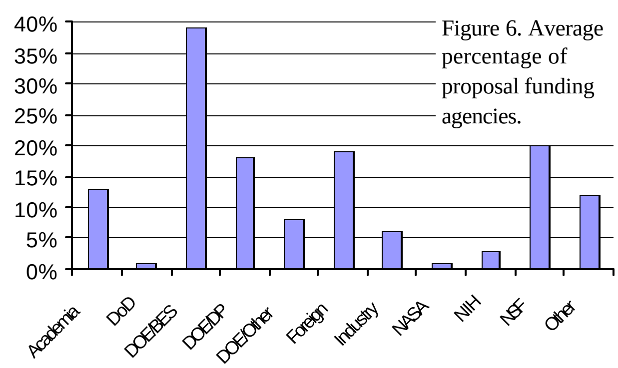


Figure 6. Average percentage of proposal funding agencies.

5.C Distribution of Users by Discipline

The data represented below was taken from the FY1997 on-site user population. An on-site user is defined as a user who comes to the Lujan Center to conduct an experiment. For experiments conducted by instrument scientists for external users, only one user per proposal (usually the principal investigator) is counted. Users are counted only once per run year, regardless of the number of times they come to the Lujan Center to conduct experimental work. This data does not include the discipline(s) of users on the Lujan nuclear physics flight paths.

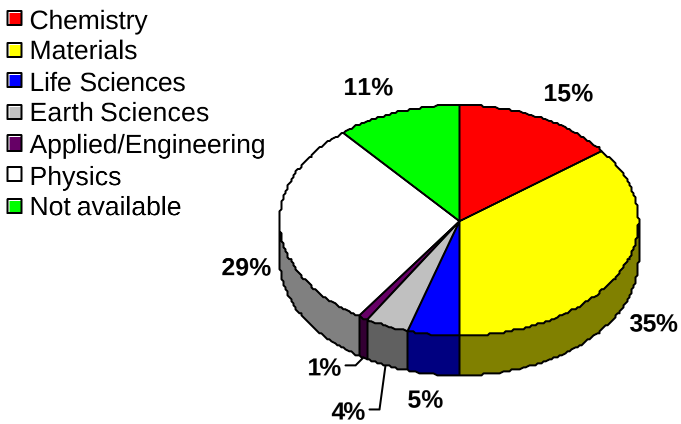


Figure 7. On-site users by discipline.

5.D Other User and Experiment Statistics

The plot below represents the number of beam-time allocations per fiscal year, as well as the number of distinct research groups receiving beam time each year. The data for 1999-2000 are not representative as experiments conducted during this period were run under the Lujan's "friendly user" program, which limits the number of distinct groups to those with sufficient experience to operate with little experimental support from the facility.

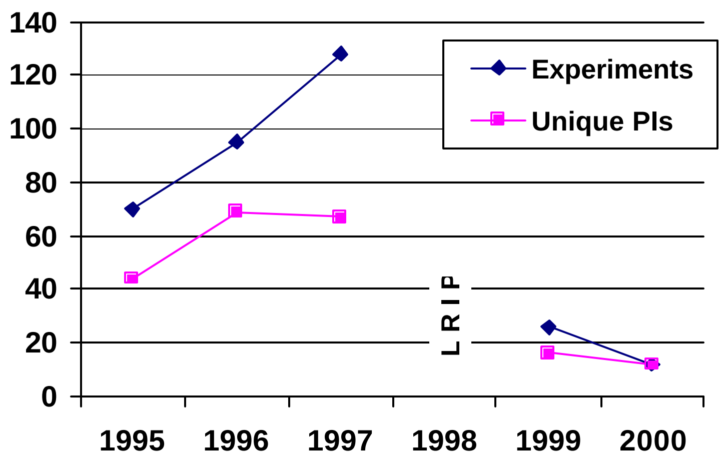
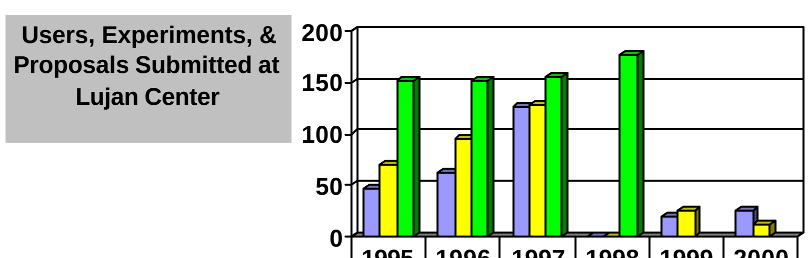


Figure 8. Number of beam time allocations per fiscal year and number of distinct research groups that received beam time during that year. Principal investigators were used to determine the number of distinct experimental groups.



	1995	1996	1997	1998	1999	2000
On-site Users	47	62	126	0	20	25
Experiments Run	70	95	128	0	26	12
Proposals Submitted	151	151	155	177	N/A	N/A

Figure 9. Number of users includes all users coming to the Lujan Center to conduct an experiment. Users are counted only once per year, regardless of the number of visits and experiments conducted. A call for proposals was not issued in 1999 or 2000.

5.E Measuring User Satisfaction
User satisfaction data have been collected from Lujan Center users in some form of questionnaire since 1993. Information regarding beam reliability, instrument readiness, data acquisition, training and administrative processes, and other areas is requested from every user at the end of each experimental run. The data is used to analyze trends and to make resource allocation decisions.

In 1999, an extensive, web-based user satisfaction system was designed to allow LANSCE staff to respond directly to user concerns transmitted via the User Satisfaction questionnaire. For all user responses demonstrating a less than satisfactory experience on any given element, a responsible party (i.e., instrument scientist for instrument readiness questions) receives notification of the comments via e-mail. The LANSCE responsible party will be able to view comments and provide resolution or potential resolution of the concern via the web. All responses will be consolidated into one e-mail message to the user. Due to the facility stand down, the debut and training for this system was put on hold until a full user program can resume in 2001. User satisfaction questionnaires are still solicited from users running under the current friendly-user mode and can be completed via web or hard copy.

The following data represents responses from User Satisfaction Questionnaires received during the 1997 run. In addition, we solicit suggestions from users regarding desired beam improvements or improvements to existing instruments/flight paths, additions of new instruments, sample environment equipment, and added *creature comforts* that would improve or benefit their experiment at LANSCE.

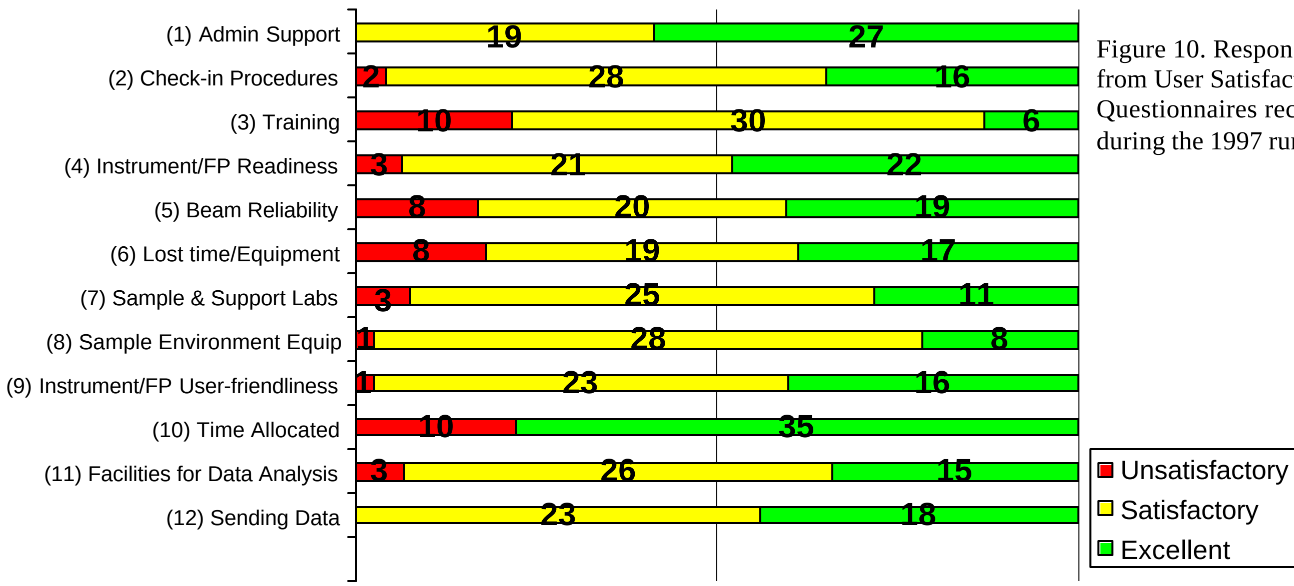


Figure 10. Responses from User Satisfaction Questionnaires received during the 1997 run.

5.F Expanding the Neutron Community
Lujan Center staff actively recruit new users through existing collaborations and new collaborations formed while giving invited talks or attending neutron-related conferences. In addition, the SDT model for construction of new instruments includes a strong incentive to expand the user constituency on each new instrument. An example of one creative SDT response is the STONE Program.

Student Travel Opportunities for Neutron Experiments (STONE) Program. An exciting new program aimed at broadening the user community, increasing access to instruments to students and faculty, and providing training to new student users in neutron scattering techniques has received funding beginning in FY2001. The STONE program is the brainchild of the new spectrometer HIPPO's principal investigator, Dr. Rudy Wenk of the University of California, Berkeley. This program, funded in part by a grant from the Laboratory's University of California Directed Research Development program and matched by LANSCE Division funds, provides travel support for students to conduct research at LANSCE. Students from any University of California or New Mexico campuses are eligible to request support funds, as long as they are a member of the experimental team on an approved proposal granted beam time via the Program Advisory Committee. The first students to be funded under this program will begin conducting research on HIPD in November 2000.

Student Employment Programs. The Lujan Center takes advantage of the Laboratory's student programs year-round. Students from local high schools, and undergraduate and graduate students from around the world, have been employed in various areas throughout Lujan operations. An important component of student employment at Lujan is the active role assumed by staff mentors during a student's term. A number of Lujan students have moved on to full-time positions at LANSCE or at other Laboratory technical groups associated with LANSCE, such as in the Materials Science and Technology Division.

The Future Neutron Scattering Community. The data below show the number of unique users on all proposals submitted each year to conduct research at the Lujan Center. As the number of instruments and available beam time limits each facility, it is clear that the existing neutron facilities cannot accommodate the number of user requests. The potential for meeting the needs of experimenters for neutron scattering as a research tool can be measured somewhat by the existing demand.

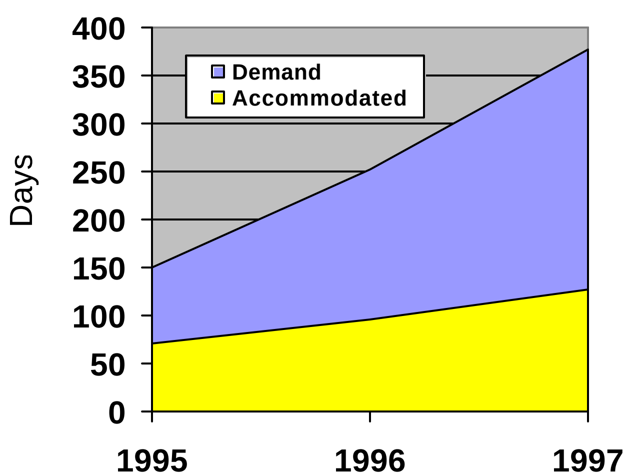


Figure 11. The required plot shows the requested beam time days per fiscal year as well as the accommodated, or actual, beam time granted to Lujan users. The limited operations during 1998-2000 are not shown. While it is possible to extrapolate this growth into the future, additional factors, such as the almost doubling of the number of instrumented beam lines at the Lujan Center over the next 2-3 years, need to be considered.

6 Impact

6.A Top 20 Papers

Following are the top 20 publications resulting from research conducted at the Lujan Center as summarized in Section 5.A.1.

	Impact Factor	Instrument(s)	Citations	Primary Discipline
ARGYRIOU, D. N., MITCHELL, J. F., RADAELLI, P. G., BORDALLO, H. N., COX, D. E., GREY, K., MEDARDE, M. L., and JORGENSEN, J. D., Lattice Effects and Magnetic Structure in the Layered CMR Manganite La2-2xSr1+2x8Mn2O7, x=0.3, Physical Review B 59, 13, 8695-8702 (1999)	2.842	HIPD, SCD	18	Physics
BAKER, S. M., SMITH, G. S., ANASTASSOPOULOS, D., TOPRAKCIOGLU, C., VRADIS, A. A., and BUCKNALL, D. G., Structure of Polymer Brushes Under Shear Flow in a Good Solvent, Macromolecules, 33 (4), 1120-1122 (2000)	3.440	SPEAR	0	Materials
BILLINGE, S. J. L., DIFRANCESCO, R. G., KWEI, G., NEUMEIER, J. J., and THOMPSON, J. D., Direct Observation of Lattice Polaron Formation in the Local Structure of La1-xCaxMnO3, Phys. Rev. Lett. 77 (4), 715-718 (1996)	6.017	HIPD	166	Materials

DAYMOND, M. R., BOURKE M. A., VON DREELE, R. B., CLAUSEN B., and LORENTZEN, T., Use of Rietveld Refinement for Elastic Macrostrain Determination and for Evaluation of Plastic Strain History from Diffraction Spectra, Journal of Applied Physics 82, 4, 1554-1562 (1997)	1.729	NPD	20	Materials
ECKERT, J., ALBINATI, A., BUCHER, U. E., and VENANZI, L. M., The Nature of the Rh-H2 Bond in LRhH2(h2-H2), L = HB(3,5-(CH3)2-py)3, The First H2-Dihydrogen Complex Stabilized by a Nitrogen Donor Ligand: An Inelastic Neutron Scattering Study, Inorganic Chemistry 35 (5), 1292-1294 (1996)	2.965	FDS	20	Chemistry
ECKERT, J., JENSEN, C. M., KOETZLE, T. F., LE-HUSEBO, T., NICOL, J. M., and WU, P., Inelastic Neutron Scattering Studies of IrIH2(H2)(pPri3)2 and Neutron Diffraction Structure Determination of IrIH2(H2)(PPri3)2.C10H8: Implications on the Mechanism of the Interconversion of Dihydrogen and Hydride Ligands, Journal American Chemical Society 117 (27), 7271-7272 (1995)	5.725	FDS	16	Chemistry
FITZSIMMONS, M. R., SCHULLER, I., NOGUES, J., MAJKRZAK, C. F., DURA, J. A., YASHAR, P., and LEIGHTON, C., Asymmetric Magnetization Reversal in Exchange-Biased Hysteresis Loops, Physical Review Letters, 84, 17, 3986-3989 (2000)	6.017	P-SPEAR	2	Materials
KENT, M. S., LEE, L. T., FACTOR, B. J., RONDELEZ, F., and SMITH, G. S., Tethered Chains in Good Solvent Conditions: An Experimental Study Involving Langmuir Diblock Copolymer Monolayers, Journal of Chemical Physics 103, 2320 (1995)	3.147	SPEAR	47	Materials
CAMPBELL, J. P., HWANG, J., YOUNG, V. G., VON DREELE, R., CRAMER, C. J., and GLADFELTER, W. L., Crystal Engineering Using the Unconventional Hydrogen Bond; Synthesis, Structure, and Theoretical Investigation of Cyclotrigallazane, J. Am. Chem. Soc. 120 (3), 521-531 (1998)	5.725	HIPD	18	Chemistry
MAJEWSKI, J., KUHL, T. L., GERSTENBERG, M. C., ISRAELACHVILI, J. N., and SMITH, G., The Structure of Phospholipid Monolayers Containing Polyethylene Glycol Lipids at the Air-Water Interface, Journal of Physical Chemistry B 101, 3122-3129 (1997)	2.385	SPEAR	21	Materials
DAYMOND, M. R., BOURKE, M. A. M., VON DREELE, R. B., and CARTER, D. H., Use of Rietveld Refinement to Fit an Hexagonal Crystal Structure in the Presence of Elastic and Plastic Anisotropy, Journal of Applied Physics 85, 2, 739-747 (1999)	1.729	NPD	7	Materials
RUZETTE, A. V. G., BANERJEE, P., MAYES, A. M., POLLARD, M. A., RUSSELL, T. P., JEROME, R., SLAWECKI, T., HJELM, R. P., and THIYAGARAJAN, P., Phase Behavior of Diblock Copolymers Between Styrene and N-Alkyl Methacrylates, Macromolecules 31, 24, 8509-8516 (1998)	3.440	LQD	12	Materials
EASTMAN, J. A., and FITZSIMMONS, M. R., On the Two-State Microstructure of Nanocrystalline Chromium, Journal of Applied Physics 77, 2, 522-527 (1995)	1.729	HIPD	21	Materials
VAIDYANATHAN, R., BOURKE, M. A. M., and DUNAND, D. C., Phase Fraction, Texture, and Strain Evolution in Superelastic NiTi and NiTi-TiC Composites Investigated by Neutron Diffraction, Acta Metallurgica et Materialia, 47, 12, 3353-3366 (1999)	1.834	NPD	1	Materials
BENDER, B. R., JONES, L. H., SWANSON, B. I., ECKERT, J. , KUBAS, G. J., KAPPS, K. B., and HOTT, C. D., Why Does D2 Bind Better Than H2? A Theoretical and Experimental Study of the Equilibrium Isotope Effect on H2 Binding in a M(eta(2)-H-2) Complex; Normal Coordinate Analysis of W(CO)3(PCy3)2(eta(2)-H-2), Journal of Am. Chem. Soc. 119 (39), 9179-9190 (1997)	5.725	FDS	26	Chemistry
KENT, M. S., FACTOR, B. J., SATIJA, S., GALLAGHER, P., and SMITH, G. S., Structure of Bimodal Polymer Brushes in a Good Solvent by Neutron Reflectivity, Macromolecules 29, 8, 2843 (1996)	3.440	SPEAR	14	Materials
BASCH, H., MUSAEV, D. G., MOROKUMA, K., FRYZUK, M. D., LOVE, J. B., SEIDEL, W. W., ALBINATI, A., KOETZLE, T. F., KLOOSTER, W. K., MASON, S. A., and ECKERT, J., Theoretical Predictions and Single Crystal Neutron Diffraction Study on the Reaction of Dihydrogen with the Dinuclear Dinitorgen Complex of Zirconium [P2N2]Zr(u-n2-N2)Zr[P2N2], P2N2=PhP(Ch2SiMe2NSiMe2CH2)2pph, Journal of the American Chemical Society 121 (3), 523-528 (1999)	5.725	FDS	13	Chemistry
DUNAND, D. C., MARI, D., BOURKE, M. A. M., and ROBERTS, J. A., NiTi and NiTi-TiC Composites: IV. Neutron Diffraction Study of Twinning and Shape Memory Recovery, Metallurgical and Materials Transactions 27A, 9, 2820-2836 (1996)	0.993	NPD	11	Materials
KING, W. A., SCOTT, B. L., ECKERT, J., and KUBAS, G. J., Reversible Displacement of Polyagostic Interactions in 16e [Mn(CO)(R2PC2H4PR2)2]+ by H2, N2 , and SO2. Binding and Activation of h2-H2 Trans to CO Is Nearly Invariant to Changes in Charge and Cis-Ligands, Inorganic Chemistry 38 (6), 1069-1087 (1999)	2.965	FDS	9	Chemistry
WONG, J. Y., MAJEWSKI, J. P., SEITZ, M., PARK, C. K., ISRAELACHVILI, J. N., and SMITH, G. S., Polymer-Cushioned Bilayers (Part I): A Structural Study of Various Preparation Methods Using Neutron Reflectivity, Biophysical Journal 77, 3, 1455-1457 (1999)	4.524	SPEAR	3	Materials

6.B Summary of Publications from 1995–present

Included as Appendix A are all identified publications from Lujan users or staff since 1995. This list only includes those publications for where a full reference could be located on common publication search engines, and where an instrument/flight path could be identified. Following is the requested summary of the distribution of these publications. In addition, the LANSCE publications database shows approximately 61 Lujan-related papers *submitted* or *in press*, not including conference publications. An annual publication call is issued in October, with the information returned over the following 2–3 months.

		1995	1996	1997	1998	1999	2000
Lujan Center by Users	Journals	33	30	33	37	54	22
	Proceedings	10	10	24	23	18	5
Other Facilities or Non-instrument Specific by Lujan Staff	Journals	10	6	14	10	17	12
	Proceedings	16	5	10	9	6	1
By Instrument	FDS	5	3	9	6	9	2
	HIPD	13	10	12	18	14	5
	LQD	6	4	4	3	2	3
	NPD	13	11	15	11	23	8
	PHAROS	3	1	6	5	5	1
	SPEAR	6	4	8	7	12	9
	SCD	4	4	2	5	10	0
	X-ray	0	3	4	10	6	2
By Primary Discipline	Biology	2	1	2	1	1	1
	Chemistry	6	3	13	9	13	4
	Geology	1	2	1	0	1	0
	Engineering	0	0	0	1	0	0
	Instrument Design/Development	11	3	6	2	4	2
	Materials	29	27	35	38	50	26
	Physics	20	16	22	28	26	7

6.C Plenary Lectures and Major Awards

The following list of invited talks from 1998-2000 by Lujan Center users is incomplete because most authors do not identify each talk as contributed or invited when they provide the information during the annual publications call (although it is requested). There are approximately 150 additional talk entries in the database since 1998 that are not included in the list below as we are unable to ascertain whether the talk was invited or contributed. Some additional data from previous years is available upon request. See Section 4.B, Quality of Staff, and Section 5.A.2, Awards by Users, for additional information.

Baker, S.M., Solvent and Shear Effects on the Geometry of End-Adsorbed Diblock Copolymers, Presented at the National ACS Meeting, Boston, MA, August 23 (1998)
Balzar, D., Line-Broadening Analysis and Standards, Presented at the 6th European Powder Diffraction International Conference (EPDIC-6), Budapest, Hungary, August 22-25 (1998)
Balzar, D., Texture by Rietveld Refinement, Presented at the 47th Annual Denver X-Ray Conference, Colorado Springs, CO, August 3-7 (1998)
Jackson, J.E., Hydrogen-hydrogen Hydrogen Bonding, Presented at the Miami University of Ohio, Oxford, OH, October 8 (1998)
Jackson, J.E., Hydrogen-hydrogen Hydrogen Bonding, Presented at the Michigan Technological University, Houghton, MI, November 13 (1998)
Jackson, J.E., Hydrogen-hydrogen Hydrogen Bonding, Presented at the Youngstown State University, Youngstown, OH, November 20 (1998)
Kent, M.S., Majewski, J.P., Smith, G.S., Lee, L-T., Satija, S.K., Rondelez, F., Polymer Brushes at the Air-Liquid Interface Studied by Neutron Reflection and Surface Tension Measurements, XVIIIth IUCR (International Union of Crystallography) Congress and General Assembly, Glasgow, Scotland, Aug 4-13, 1999
Kent, M.S., Majewski, J.P., Lee, L-T., And Satija, S.K., A Model Study of Tethered Chains Using Langmuir Monolayers of Diblock Copolymers, 218th ACS Annual Meeting, New Orleans, Aug. 22-26, 1999
McCall, K.R., Neutron Scattering Probes of Water in Rock, IGPP Seminar, UC San Diego, May 1999

Sheldon, R.I., Hartmann, T., Sickafus, K.E., Ibarra, A., Scott, B.L., Argyriou, D.N., Larson, A.C., Von Dreele, R., Cation Disorder and Vacancy Distribution in Non-Stoichiometric Magnesium Aluminate Spinel MgO.xAl2O3, Presented at the 100th Meeting of the American Ceramics Society, Cincinnati, OH, May (1998)
Sheldon, R.I., Hartmann, T., Sickafus, K.E., Ibarra, A., Scott, B.L., Argyriou, D.N., Larson, A.C., Von Dreele, R., Cation Disorder and Vacancy Distribution in Non-Stoichiometric Magnesium Aluminate Spinel MgO.xAl2O3, Presented at the 100th Meeting of the American Ceramics Society, Cincinnati, OH, May (1998)
Todd, R., Measurement of Residual Stresses in Ceramics by neutron Diffraction, Fluorescence Spectroscopy, and Curvature Measurement, Presented at the Institute of Physics Conference on Materials Evaluation in Ceramics, September 15 (1998)
Ustundag, E., Neutron Diffraction Studies of Structural Materials: The Present and the Future, Presented at the University of Southern California, Department of Materials Science and Engineering, Los Angeles, CA (1998)
Ustundag, E., Neutron Diffraction Studies of Structural Materials: The Present and the Future, Presented at the Rockwell Science Center, Thousand Oaks, CA (1998)
Ustundag, E., Partial Reduction Reactions in Spinel Oxide Compounds: A Review, Presented at the American Ceramic Society Annual Meeting, Cincinnati, OH (1998)
Vogel, S., Fitting Bragg-edges, Transmission Project Meeting No. 2, July 2, 1998, Open University, Milton Keynes, UK
Vogel, S., In-situ Investigation of Structural Phase Transitions Using Neutron Transmission, Materials Science Seminar, Keck Laboratory, California Institute of Technology, March 25 (1999)

6.D Publication Statistics

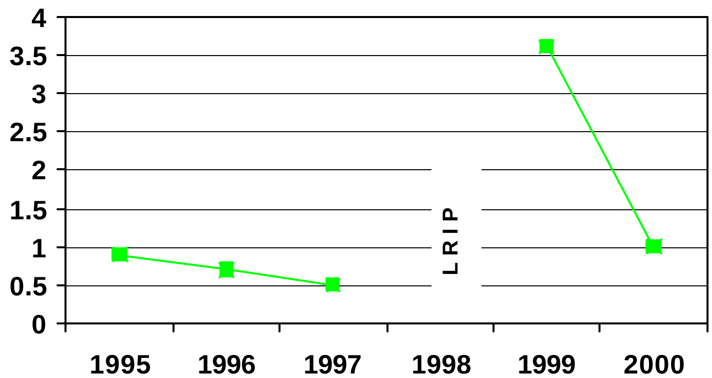
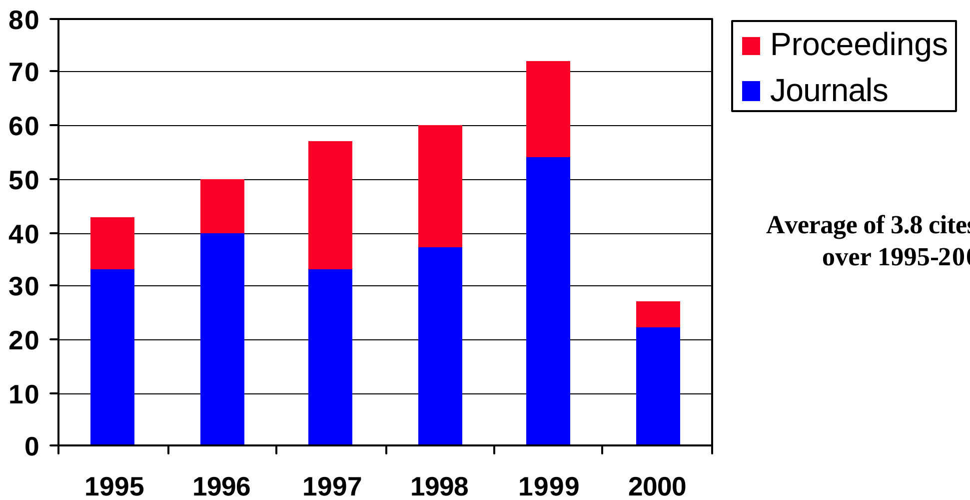


Figure 12. This graph attempts to demonstrate the average number of papers per user. Since a typical paper takes ~1-3 years from the time data is taken until publication, the statistics will appear skewed over short periods of time.



Average of 3.8 cites/paper over 1995-2000

Figure 13. Lujan Center publications per year. Publications by Lujan staff based on research at other facilities are not included.

7 Cost Effectiveness

7.A Funding Sources

The DP commitment to LANSCE provides BES with an opportunity for considerable funding leverage.

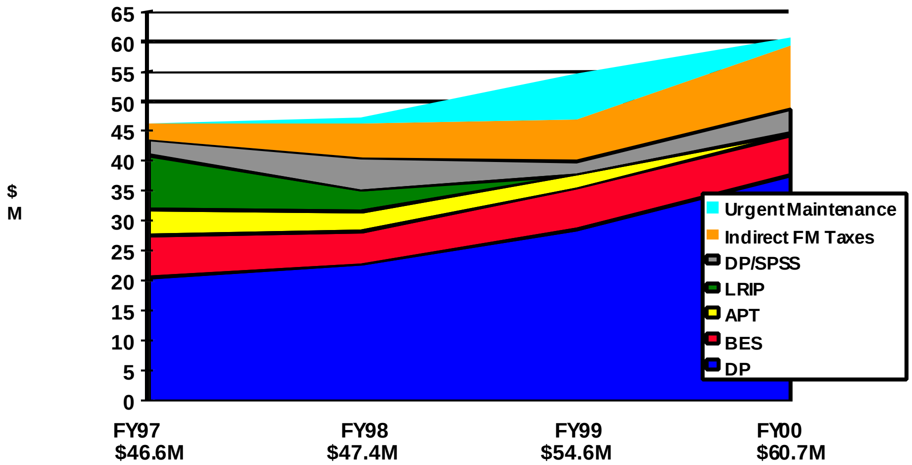


Figure 14. Evolution of LANSCE User Facility operating and facility management and infrastructure costs (FY1997–FY1999 actual costs and FY 2000 budget).

7.B Cost per Paper

	1996	1997	1998	1999
Cost per Lujan Experiment Paper[1]	145K	118K	93K	92K
Cost per Lujan Experiment or Staff Paper[2]	133K	106K	92K	77K

[1]This figure represents the cost per paper including the total BES operating budget for Lujan research papers. It does not include papers published by Lujan staff where research was conducted at another facility.

[2]This figure represents the cost per paper including the total BES operating budget for Lujan research and Lujan staff research papers. All budget figures are per FY; publication numbers are by calendar year published.

7.C Cost per Delivered Beam Day

Total Operations Cost per delivered beam line day takes the overall operations budget for the entire LANSCE facility divided by the number of days beam was delivered to a beam line. It is important to note that on some days, all beam lines at the Lujan and at WNR accepted beam. On other days, beam was delivered to Area C only for proton radiography. Notwithstanding these very different modes of operation, all individual experiments were considered equal in this analysis. BES cost per delivered beam line day takes the BES budget and divides it by the total beam line days at the Lujan Center that were not explicitly used in Defense Programs experiments.

Total Operations Costs

	FY95	FY96	FY97	FY98	FY99	FY00	Estimate* Out Years
Total Operations Dollars	$ 28,533	$ 31,742	$ 34,806	$ 28,536	$ 32,255	$ 35,089	$ 34,900
Total Ops k$/BL Hour	$ 0.816	$ 0.849	$ 0.652	$ 25.801	$ 1.595	$ 1.966	$ 0.515
Total Ops k$/BL Day	$ 20	$ 20	$ 16	$ 619	$ 38	$ 47	$ 12
BES Costs							
Total BES Dollars	$ 33	$ 5,793	$ 6,111	$ 5,093	$ 6,094	$ 5,621	$ 9,000
BES k$ / BES per BL Hour	$ 0.006	$ 0.376	$ 0.288	$ 7.659	$ .214	$ .073	$ .208
BES k$ / BES per BL Day	$ 0.144	$ 9	$ 7	$ 184	$ 29	$ 50	$ 6

* Estimate for out years assumes 8 months (4,000 hr) for 17 FP (3.5 are DP) and FY01 funds.

With several uninstrumented beam lines, there is extensive opportunity for the expansion of the Lujan Center experimental capabilities. With each new spectrometer, the BES cost per beam line decreases as the fixed costs are averaged over more instruments. The marginal cost to operate an additional spectrometer is approximately $6K per beam line day.

8 Milestones Compared to Performance

In FY1997, the most recent year in which we ran for our goal of 8 months, Lujan Center received 85.7%**.** Our milestone for this metric is 85%.

8.A Outside Review Report from 1999

Appendix B contains the most recent LANSCE Division Review Committee report.

9 The Future

9.A The Lujan Center's Role Before and After the SNS

With the completion of funded upgrades, the Lujan Center will have the highest peak intensity and will equal the highest average flux for pulsed spallation sources. With the completion of funded instrument construction, the Lujan Center will have the most modern set of spallation neutron instruments. Until the completion of the SNS, the Lujan Center will have the premier pulsed neutron capabilities in the United States. The Lujan Center will be essential to the development of spallation neutron science in anticipation of the SNS and will be critical in developing and training the research community needed to take full advantage of the SNS. The Spectrometer Development Teams that are constructing new instruments are also focusing on the expansion of user community with particular emphasis on the inclusion of researchers from disciplines that have not traditionally been involved in neutron scattering. As the only spallation source in the world with partially and fully coupled moderators, the Lujan Center is uniquely capable of exploring and exploiting the opportunities afforded by their high-integrated flux/long-pulse characteristics. Understanding the opportunities and demonstrating the capabilities of these novel moderators will be of great importance for the final design of the SNS. This is particularly true for the second target station at the SNS as it is specifically concerned with the optimal exploitation of long-wavelength neutrons that particularly benefit from moderator decoupling.

What upgrades are approved for funding—source and instruments?

The SPSS accelerator project includes support for a new ion source, improvements to the PSR, and reduction of losses in the Lujan target extraction line. When complete, LANSCE will be able to deliver 200 microamperes at 30 Hz to the Lujan target. The SPSS spectrometer development project includes the construction of five new spectrometers (HIPPO, SMARTS, Protein Crystallography, SABER, and VERTEX), which are described in Section 2.E, Investments in Instrument Suite. The NSF is supporting an upgrade of NPD to optimize its performance for structural investigations. LDRD funds are in hand to develop the novel multichopper spectrometer IN500 and the magnetic spectrometer Asterix. The DOE Office of High Energy and Nuclear Physics is supporting the extraction of a cold beam line FP12 for use in a series of fundamental neutron physics experiments. Defense Programs and LDRD are supporting the construction of a nuclear physics instrument on FP12 for both defense research and astrophysics.

How are you responding to problems identified by users?

LANSCE management maintains close contact with the LANSCE User Group Executive Committee with a monthly conference call and an on-site meeting 3-4 times per year. LANSCE also sponsors the annual user group meeting, which is organized by the LUG Executive Committee for all users. The User

Satisfaction questionnaire, given to all on-site users, is also a mechanism for collecting specific user information regarding their experimental programs at LANSCE (see Section 5.E, Measuring User Satisfaction).

The overwhelming issue for the users over the last year has been the operations schedule. We have kept users informed of milestones and progress through communications via e-mail and the web, and have requested feedback and input to the operations schedule from the LUG Executive Committee.

What are the needs for new instruments/upgrades in the next 2-3 years?

See Section 2.E, Investments in Instrument Suite, for information on new instruments and upgrades.

9.B Increasing the Neutron User Base
See Section 5.F, Expanding the Neutron Community.

9.C Vision
When the SNS becomes fully operational, it will become the neutron source of choice for certain experiments. As an example, for inelastic neutron-scattering experiments with relatively high-energy transfers, the SNS will outperform the Lujan Center by an order of magnitude. In other areas, such as the use of cold neutrons for scattering experiments, the SNS is likely to exceed the capability of the Lujan Center only by a factor of two or three. The upshot will be that perhaps 10 to 30% of experiments (depending on the scientific area) will absolutely require the SNS, but most will be do-able either at the Lujan Center or the SNS. The proof of this assertion is provided by current spallation sources: ISIS in the United Kingdom provides an order of magnitude higher neutron flux than the Intense Pulsed Neutron Source at Argonne National Laboratory, yet there certainly is ***not*** an order of magnitude difference in scientific productivity. The two facilities produce indistinguishable numbers of citations per paper and very similar numbers of papers per instrument day, for example. In point of fact, with the completion of the SNS, the US will still face a shortage of neutron scattering capability.

Quite apart from the comparison of SNS and the Lujan Center for neutron scattering, LANSCE will continue to be a facility with much broader scientific impact than the SNS. The SNS will not have a high-energy neutron source such as the WNR, nor will it attempt isotope production or PRAD. The proposed ultra-cold neutron facility utilizes the LANSCE proton beam and such a facility is not possible at the SNS. In addition, unless there is a major change in the political landscape, LANSCE will remain the only high-intensity neutron source at which classified experiments can be easily and regularly accomplished.

APPENDIX A

Publications

(see separate PDF document)

APPENDIX B

Current LANSCE Division Review Committee Report

Lee S. Schroeder, Director
Nuclear Science Division
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August 7, 2000

Dr. John Browne, Director
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Dear Dr. Browne:

I would like to clarify a point regarding the reference to the LANSCE "safety stand down" that we made in our LANSCE Division Review Committee Report, forwarded to you on July 29, 2000 and also in the Report's cover letter. I understand that this phrase may be subject to misinterpretation and want to make sure that you understand the context in which it was used.

The term "safety stand down" should be viewed as an inclusive one. In this way, it was meant to include **several** safety-related events that occurred at LANSCE during the period between the DRC meetings. Specifically, it includes:

9 the safety shut down which occurred between Feb.'99 and Jun'99, after which the linac delivered 5000 hours of outstanding operation for LANSCE's DP program—PRAD, WNR, ? CN neutrons, etc.

10 work required for the BIO activity and analysis of new potential hazards for the Lujan targets

11 activities needed to move toward a 'nuclear facility' classification, and

12 cleaning of the rad drains (a legacy issue) at the Lujan Center.

Much of the committee's concern was focused on getting the Lujan Center back up and running, so that we tended to lump all these items under one category—the "safety shut down," rather than breaking them out separately (which Roger did in his presentation of LANSCE's Safety Journey).

I'm sorry if this usage has led to some confusion—I trust that this brief note help's clarify it. I am very pleased to hear from Prof. Shenda Baker (DRC member), presently at Los Alamos, that protons are being delivered to the Lujan target and neutrons to Lujan instruments. This is what is needed to demonstrate to the neutron scattering community that LANSCE is a reliable place to get its neutrons.

Best regards,

Lee S. Schroeder
For the LANSCE DRC

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Lee S. Schroeder, Director
Nuclear Science Division
(510) 486-7890
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July 29, 2000

Dr. John Browne, Director
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Dear Dr. Browne:

Enclosed is the LANSCE Division Review Committee Report following our meeting of May 2-4, 2000. Several LANSCE DRC members were not able to attend this meeting, so our ‘coverage’ of all the science and technology issues presented is not as complete as we would like. Also, the terrible Los Alamos area fire occurred just a few days after the review. Recommendations for actions in this report, of course, are not able to reflect that singular event and its consequences LANSCE/Lujan activities. However, recent emails from LANSCE have indicated that operations are returning and, in particular, delivery of beam to the Lujan Center has made great progress. We are very pleased with this, as much of the report focuses on the disposition of the Lujan Center and the imperative to deliver beam to the neutron scattering community.

The committee was very pleased with the presentations from LANSCE staff. They were generally of an outstanding quality and the interactions and discussions with the DRC were excellent. It is clear that the “safety stand down” at LANSCE extracted a heavy toll on LANSCE management and staff and lead to no beam for research at Lujan. Despite this, it must be said that the DRC was very impressed with the delivery of 5000 hours of beam to other activities at LANSCE – this is world-class operation and allowed a wide range of outstanding science to be carried out.

Our central recommendations deal with the Lujan Center and the absolute need to deliver neutrons for the neutron scattering community. The DRC feels strongly that this must be the central focus of near term activities at LANSCE. If the neutron scattering community (and its sponsors) are to return to Los Alamos, the Lujan Center must be operated safely, reliably and predictably. The focus should be on running a few instruments and getting science out. This will get people’s attention!

If you have any questions regarding out report please do not hesitate to get in touch with me or any member of the LANSCE DRC.

Best regards,

Lee S. Schroeder
For the LANSCE DRC

1 Introduction

The Los Alamos Neutron Science Center (LANSCE) Division Review Committee (DRC) met at Los Alamos National Laboratory from May 2-4, 2000, to conduct a review of the LANSCE Division. This review covers approximately the period from March 1999 through April 2000. Most of the DRC membership were in attendance; however, three members (Dr. Michael Anastasio, Prof. Mike Cornwall and Prof. Alan Leadbetter) were unable to attend. This affected the DRC's ability to adequately cover some of the LANSCE areas we were charged with reviewing (Note: Prof. Leadbetter did visit LANSCE prior to our meeting and did provide feedback to the DRC and LANCSE management). The full membership list is included as an appendix, along with the Charge to the Committee and the meeting agenda. This review covers a little over one year since the last review of LANSCE. This period involved significant events, such as the 'safety stand down,' with substantial impact to LANSCE and its programs. In addition, the present review took place just days before the disastrous May 2000 fire, in and around Los Alamos. This needs to be taken into account when the observations and recommendations contained in this report are being considered.

This year, as in the Committee's charge for its 1997 report, we were asked to award grades. We were requested to consider these in the context of the DRC's charter addressing the four review criteria specified by the University of California President's Council:

9. "quality of science"
10. "relevance to national needs and agency missions"
11. "performance in construction and operation of major research facilities"
12. "programmatic performance and planning."

This assessment reflects the case that the LANSCE facility has several important roles. It is a critical component of DOE's Stockpile Stewardship effort with emphasis on neutron capability to address important issues related to nuclear weapons and it aspires to provide a world-class neutron scattering capability for basic research in condensed matter, material research and other important research areas. Taken as a whole, LANSCE is the centerpiece of the laboratory's goal of Los Alamos being known as the "neutron laboratory."

The committee wishes to say a few words about this year's review. The meeting was very effective and all staff are to be congratulated for their presentations and willingness to 'fill in the details' when questions arose. There was a great deal of 'honesty' displayed in the course of the presentations and discussions—LANSCE management and staff didn't hold back, e.g., on such things as comments related to the 'safety journey' and its overall impact on LANSCE capabilities and relationships with the DOE. The poster presentations, while few in number, were excellent and committee members were able to have quality time with several staff members at that time. We learned a great deal from the posters about the LANSCE facility, its research program (DP and Science), the SPSS enhancement project and other elements of the LANSCE program. This year's Self-Assessment document was a great improvement over last year's and contained much useful information. For next year, the Committee would like to see more discussion on planning and overall context of the LANSCE facility, as part of such a document. The committee was pleased that Roger Pynn, during his presentation(s), responded to many of the comments and issues contained in last year's DRC report. We recommend that items such as the Self-Assessment document and responses to this year's report be sent out well in advance of the next meeting—this will be very useful to the next committee and can help focus the review.

13 <u>Performance Assessment</u>

Before discussing the specifics of our report, we present our overall assessment in the context of the University of California President's Council four review criteria. We do this taking into account the safety shutdown which affected LANSCE over the past year.

9 Quality of Science:

Despite the "safety stand down," the LANSCE facility, exclusive of the Lujan Center, performed at a very high level during the last year. The linac delivered over 5000 hours of protons for the DP program—this is world-class operation. It was a very successful year for DP activities, e.g., the proton radiography (PRAD) program performed spectacularly, a very substantial program was carried out at WNR and important science was conducted, including valuable studies related to the better understanding of the PSR and its ability to provide high currents for the Lujan Center. The outstanding operation of the linac, which directly contributes to the quality of LANSCE science, the great success with PRAD and WNR, warrant an outstanding to excellent score for LANSCE. The lack of operation of the Lujan Center tends to reduce the overall score.

10 Relevance to National Needs:

LANSCE offers unique capabilities to the national effort in the area of Science Based Stockpile Stewardship (SBSS). Its contributions to new capabilities, such as PRAD, and significant science measurements (for defense programs and non-classified basic research) at WNR (e.g., (n, 2n)) are outstanding. With the decrease of neutron capability (pre-SNS) throughout the United States (HFBR shutdown, NIST and HFIR off-line for source enhancements), it is absolutely essential that LANSCE succeed and be a steady, reliable neutron source. When operating, Lujan should be a principal source of student training, not only for today's science but also for developing a cadre of young researchers for SNS. The Isotope Production Facility (IPF) will be an important addition to the United States' capability to produce radioisotopes. Such isotopes are a 'strategic resource' for the United States. They are of great importance to the medical community, biological and life science researchers. LANSCE's potential to contribute to the national and international scene is truly outstanding. It demonstrated this during last year's operations.

11 Performance in the Const. and Operation of Major Research Facilities:

The review year was **mixed** for LANSCE in this area. On one hand, operation of the linac and the performance of the DP-aspects of the program were at a very high level, yielding significant new science and opening up new scientific opportunities. On the other, the 'safety stand down' did not allow operation of the Lujan Center, a keen disappointment to the LANSCE staff and the affected neutron scattering community. While the IPF appears to be behind its construction schedule, activities are planned which could alleviate and put it back on track.

12 Programmatic Performance and Planning:

Again, the year was **mixed** in this category. With the outstanding delivery of 5000 hours of protons by the LANSCE linac, the DP program was able to make substantial strides. Also, with the help of the LANSCE staff, elements of the DP research community (particularly WNR) were able to respond quickly to the availability of large amounts of beam time. However, given the critical need to repair infrastructure (the "run to failure" mode that will be addressed later in this report) it may have been appropriate and more opportune to have cut back on running time and put some of the (admittedly) limited resources into assuring reliability of the LANSCE accelerator complex.

The committee would like to make a general comment regarding last year's 'grading' which may be useful to the University of California (UC), the Department of Energy (DOE) and Los Alamos. Last year's scoring by UC and DOE were shared with the committee and we found this very useful in our discussions and deliberations. Both the UC and, in particular, DOE's grading of LANSCE were lowered relative to the DRC report. The DRC has no problem with this, but would like to point out that the periods covered by the various reports and their corresponding ratings **represent very different time frames**. In particular, last year's DRC report, did not and could not have reflected the events that occurred following the "safety stand down" at LANSCE. As a further example, the present report can not reflect consequences resulting from the terrible fire that occurred in the Los Alamos area immediately after our review. We hope that these comments are useful to the various parties as they pull together their own assessment reports in the future.

1. Other Remarks

Before moving on to the more specific elements of the charge for this review, a few remaining comments summarizing the sense of the committee are included below:

There is one principal message that the committee wants to impart to both LANSCE and Laboratory Management and staff. The primary goal for LANSCE over the next several months must be—**run Lujan! Run it safely, reliably and predictably.** We fully appreciate that LANSCE staff has been working hard toward this goal. As discussed, it was a very successful year (on a limited budget) for the DP program--a year that everyone can have a strong sense of pride in. To top this off, the success of Lujan has to be accomplished. Summer 2000 may represent the last opportunity to attract the neutron scattering community to Lujan and LANL. LANSCE and LANL can be the "neutron laboratory"—a success with Lujan is central to that theme. Our best advice is:

10 run Lujan (through October)
11 run three (3) instruments (concentrate on what you have, get the science out)
12 other things may have to be postponed or abandoned to accomplish this
13 reliability and creditability at Lujan is uppermost

14 a substantial, but not optimal, budget exists—you must perform within this constraint to gain credibility with your sponsors and user communities.

Having indicated the committee's sense above, we also realize that the "run to failure" mode of operation, identified in our last report, is still in place. As discussed later, potential failure points (e.g., RF tubes) are known. These exist because the LRIP project was really not completed; there is much more that needs to be done to the LANSCE infrastructure to guarantee long-term reliability and success of operation for the DP and Science programs. This indicates the need for additional Accelerator Improvement Projects (AIP) funding. Planning will be essential and both LANSCE and the laboratory will need to get behind this to make the strongest case to the sponsors. In particular, sufficient funds need to be provided by the DP program to realize fully the unique opportunities for SBSS that are present at LANSCE.

A final comment with regard to communications with DOE. The assessment document indicating DOE's S&T grading of LANSCE was a real eye opener. The committee believes that this is indicative of "broken lines of communication" between LANSCE and DOE/DP and possibly even more broadly. **This must be improved.** As one part of an effort to rectify this, the committee recommends that DOE representatives from the DP and BES program offices (and others as appropriate) be invited to attend the DRC meetings, as well as tours of the LANSCE facilities. More and better communication with DOE at all levels is essential to LANSCE's future.

2. The Other Elements of the Charge

The more specific elements of the charge we were asked to comment on, include:

15 User Facility Operations and Scientific Accomplishments
16 Strategic Planning
17 The SPSS Enhancement Project
18 Proton Radiography
19 LANSCE-2 and –5
20 LANSCE-9.

As stated earlier in our report, some of these areas lacked the appropriate expertise on the committee due to reduced membership at this review.

User Facility Operations and Scientific Accomplishments

As described earlier the review period had significant accomplishments in the area of operations and associated scientific activities. The delivery of 5000 hours of beam was essential to the science that was carried out. Notable during this period was the high productivity of the PRAD program and the effective use of beam for WNR and nuclear science experiments, with the (n, 2n) measurements with GENIE being particularly noteworthy. In addition, experiments exploring new opportunities related to ultra-cold neutron source development were successful—these were carried out in the Blue Room. New efforts to measure n-p capture cross sections are of importance to cosmology were realized. On the applications side, neutron induced single event effects measurements and neutron radiography made progress. Mercury target shock tests were carried out that are very important to the SNS and its future target assemblies. Many important nuclear science related experiments were carried out, with over 100 users at WNR.

As noted previously, the Lujan Center has not run since our last review. Nevertheless, Lujan scientists have been scientifically productive during this period, publishing in a wide variety of areas such as magnetic and polymer films, zeolites, colloids, complex fluids and superconductors. Several of the efforts identified in the last review, such as the development of Rietveld codes and the measurement of strain in materials have continued to be productive. Part of this productivity resulted from publication of work done at the Lujan Center during the short running period before the shutdown. Other work is the result of "suitcase physics"—work carried out at other facilities—by Lujan staff. Regardless of the location at which the work has been carried out it has been of high quality and addresses important and current scientific problems.

The scientists at the Lujan Center have produced significant and important results during the past year—in spite of the fact that they have not had an operating neutron source. However, for Lujan to maintain a vital scientific program the neutron source must run so that LANSCE scientists can carry out research at LANSCE. Furthermore, the source must run reliably and predictably so that scientific programs can be planned and executed.

But having indicated the above, the committee cannot fail to comment on the very evident fact that both the LANSCE facility and its programs appear to be "running to failure." It is the judgement of many that a large part of these problems are due to insufficient, uncertain and late budgets. It has been suggested that an increase in operating funds of about 20% would be needed on an ongoing basis to keep the staff, spare parts, etc., at a suitable level for sustained operations. Considering the huge past investment (possibly in the billions) and the great potential for both science and SBSS needs, every effort should be made to see that this "flagship" for the Los Alamos National Laboratory does not fail as an operating facility.

In addition to the operations shortfall both the BES and the DP program are not commensurate with the potential of this national facility. While BES has committed to building many of the new instruments it is not clear that the commitment to operate them is there at the level which will attract the national user community for both LANSCE now and SNS in the future. On the DP side, the support for weapons nuclear and materials science is actually being cut back just at the time it is becoming more evident that there are many opportunities to impact the campaigns in the defense sciences. This will produce a situation which is untenable for DP, an expensive facility "flagship," without the productivity to justify its existence. In the last two years, the DP program budget has been estimated to be only half of what would be sensible for such a valuable program, and this year it is only one third of what a reasonable activity could be.

Finally, a comment on the role of LANSCE in the SNS project. While the project has been rightly separated from the LANSCE division as such, the division still plays a very significant role directly for the project because, as a user facility, it is needed for many different reasons. Some of which are:

21 the need to do pulse stress tests of the SNS mercury target
22 materials irradiation must be done as part of the SNS project
23 the issue of coupled moderators can be studied
24 there are still many nuclear cross sections which need to be measured
25 the H^- source, PSR instability and stripper foil studies are important to SNS
26 some of the new scattering instruments at Lujan will be valuable developments for the SNS instrumentation suite.

In addition to the above list, which is not exhaustive, the presence of a healthy LANSCE and Lujan in the next five years can serve to build up and educate the neutron scattering community. Of course, one must not forget that LANSCE expertise will also be used to build part of the linac, the RF and the control systems for SNS. However, these activities should be carefully focused away from LANSCE operations and programs in order not to divert management's attention from the safe, reliable and predictable operation of both the facility and its programs.

Strategic Planning

The Division now recognises that its long-term plans are tightly bound to successful operation of the Lujan Center and the committee supports this view very strongly as it has done for the last few reviews. Credibility with the Lujan Center users must be established. The Division recognizes that little support will be found for future projects like LPSS and AHF until then.

The vision and mission statements are still seen as highly relevant to the LANL objectives. However, there are some questions over the Division's organization relative to its place in LANL. The main question concerns the status given by LANL management to the Lujan Center. National neutron scattering centers in Europe appear to place the user community in a more dominant position than that existing at LANSCE. Although this may just be a question of perception, it may be having an influence on the funding and resources that sponsors are prepared to provide for the Lujan Center. The laboratory should consider giving LANSCE and, in particular, the Lujan Center, a higher profile and management status within the LANL complex. With authority goes responsibility and it is then clear where the buck stops.

Last year the committee recommended that LANSCE needed to be "moved up the food chain" if appropriate funding levels were to be found to change it into a fully credited national neutron user facility. Although some successes can be found in the new instrument program there is still a difficult funding situation relative to the operational expectations of the facility.

As stated last year the work scope must be tailored to the budget and it is essential for LANL to find a way of passing this control of scope to LANSCE. They must be allowed to optimize their operation within the available funding. Thus, while funding is available for the Isotope Production Facility and for new Neutron Scattering Instruments there is insufficient funding and resources to replace obsolescent equipment and to resource fully the existing instruments. However, failure to replace the obsolescent equipment will make the new additions to LANSCE much less effective than they could be. In addition, the LANSCE Facility operated for 5000 hrs in FY '99 consuming $6.3M for electricity. It might have been more beneficial to operate for 4000 hrs, saving perhaps $1.0M and using this for replacement of obsolescent equipment and instrument support. This type of decision should be under the control of LANSCE Division, if it is not so already.

The long-term plan must include the replacement of obsolescent equipment if the "run to failure" mode is to be avoided. The replacement of obsolescent equipment should show increased efficiency and may allow the use of commercial contracts for maintenance. This will be a program that takes several years.

Considerable effort is going into planning and staffing assessments based on a minimum recruitment mode imposed on LANL. Some exceptions to the minimum recruitment program are allowed and additional staff will be needed to achieve national neutron facility status. Many of these need not be top-flight scientists and this should be taken into account when recruiting is requested. Long term support for the new instruments must be forthcoming from a willing sponsor if success is to be assured.

<u>SPSS Enhancement Project (Ion Source, Instrumentation, Beam Delivery)</u>

<u>Ion Source</u>

First, the H^- Ion Source development program has shown great progress. The source has been thoroughly studied and a good collaboration has been set up with LBNL. The beam performance is well up to the specification and a well prepared plan for installation and commissioning has been established. A back up plan that would allow the use of the old ion sources is also in place. An excellent piece of work.

<u>SPSS Instruments</u>

The Short Pulsed Spallation Source (SPSS) enhancement project has funded the development of five new instruments for the Lujan center. The first three instruments seem to be well on track. They are ready and, as soon as the experimental halls are accessible, will begin installation. These instruments are within their budget, although the contingency remaining on SMARTS is alarming low. However, the success of obtaining outside funding for HIPPO has left their budget flush. Realistic installation plans for the instruments exist and they are expected to take first beam during the Lujan cycle beginning in 2001. It is essential not only that these instruments be installed on schedule but also that the Lujan center resumes reliable and predictable operation in 2001 for these instruments. Without an operating source these instruments will not be viewed as successful.

The remaining two instruments, whose SDT's have not been based at LANL, have been problematic. These instruments have not produced an approvable technical baseline in 2 years while the currently funded instruments took about 6 months to produce fundable plans. This delay is, in part, due to the fact that the SDT mechanism is a new way to build neutron scattering instruments and in part due to the fact that both the instrument design and scientific leadership were based outside LANSCE. The successful instruments had a design core of LANSCE staff. LANSCE has recognized these problems, identified internal people to take the lead on design and engineering and these instruments now seem to be moving forward. HELIOS has a clear plan forward (as a combination of the current HELIOS concept and PHAROS, solving the long standing financial drain of the latter instrument as well) and progress on HERMES is expected shortly. We look forward to substantial progress on these instruments at the next meeting of the DRC.

Timely and successful installation of these new instruments is a high priority. However, the installation of these instruments cannot compete with the successful operation of existing instruments fully supported for the user program . The Lujan management has expressed a clear vision for operating a limited number of instruments reliably and predictably for the user community. We view this as an excellent plan that realistically reflects the limitations place on the center by funding constraints. To gain credibility as a national user facility, the Lujan center must run a subset of its existing instruments, consistent with the allocated resources, in a manner consistent with world class operation. Installation of the new instruments cannot take priority over the operation of the existing instruments for the user community.

When these instruments are on-line it is essential that they be adequately staffed to allow reliable, predictable and scientifically successful operation. The Lujan center must obtain additional funding and attract people to support these instruments. If sufficient resources cannot be obtained to operate all instruments in a fully-supported, user mode, Lujan and LANSCE management must choose which instruments they will support and then support them sufficiently to ensure reliable operation. At this point, consistent, reliable, high quality instruments and science are much more important than quantity.

SPSS Beam Delivery System

Some of this has been discussed above, but is worth repeating. The developments for a high-current (150-200 mA) upgrade of the beam delivery system for the Lujan facility have been impressive. The H^- ion source development in collaboration with LBNL is a piece of engineering of the highest caliber (full H^- current, very low electron contamination). We feel confident *that the emittance can be reduced by the required factor of two. PSR instabilities have been much reduced and are better understood. The goal of a 150-200 mA average beam current for Lujan seems within reach. Chances of completing preparations for component installation during the next shutdown look good but some uncertainties remain.*

However, on a strategic level, we feel that the measures recommended for increasing the reliability of beam delivery should take the highest priority for the next shutdown. Thus, the SPSS installation program should be planned such that it does not interfere with reliability upgrades and does not become the critical path for the shutdown. Careful planning for SPSS installations are vital.

Proton Radiography

The very successful proton radiography (PRAD) program must be enthusiastically embraced. While PRAD will eventually involve a large new project operating between 20-50 GeV with many elements, it must not be forgotten that the 800 MeV LANSCE facility has produced several radiography programs which are extremely valuable now and in the longer term. Both the high explosive experiments and the spall experiments with LANSCE protons could and should evolve into significant weapons and science user programs. It is notable that both LLNL and the British Atomic Weapons Establishment have been involved. In addition to these proton initiatives it has become clear that neutron resonance spectroscopy can be very valuable to the weapons program as a way of measuring flow velocities and temperatures. At present, it appears that this potential program will not really get started.

One of the many initiatives which could increase productivity of the PRAD program and LANSCE's ability to serve several customers is the proposed kicker magnet. This would allow near simultaneous operation of more of the experiments. Even if the ideal solution to the kicker cannot be afforded in the present funding climate, every effort should be made to somehow move in this direction. LANSCE cannot be an effective user facility if the competition for beam time is not addressed.

LANSCE 2

The group has proven itself very effective in its main task of maintaining and improving the beam delivery system despite very serious funding shortages. They have addressed many old deficiencies, some of which surfaced during the safety stand down last year. As a result, over 5000 hours of beam were delivered last year with 90-95% reliability. This is a world class performance. The stripper foil development for PSR looks very promising and should be very helpful in future operations. Finally, the new isotope production (IPF) beam line is well on the way as is the SPSS program (see earlier comments on SPSS).

Having said this, it is nevertheless obvious that inadequate funding has strained resources for maintenance and upgrades, to the limit and possibly beyond. The resulting shortcomings make future reliable beam delivery uncertain.

This shortfall of current and projected funding for operations which affects beam delivery (LANSCE 2) and the Lujan target station (LANSCE 7) is a sure-fire recipe for failure. To illustrate the level, to which maintenance and upgrades of beam and target systems have fallen due to lack of funds, we list some of the more drastic cases:

<u>At LANSCE 2</u>

a) The linac vacuum pressure is marginal, since 20% of the pumps are not operating to specifications. No spares are at hand. No vacuum engineer is available. No machine protection against accidental back fills exists.
b) Linac quadrupole insulation is crumbling. No spares are available.
c) Some of the 164 linac drift tubes have begun to show water corrosions leaks. There are no spare tubes. On-site repair techniques are comtemplated to extend tube life.
d) The PSR cooling system retrofit is only 40% complete.
e) No early-failure detector systems are in place.
f) Repair procedures and inventories are largely undocumented and rely on "corporate memory" which is rapidly diminishing.

<u>At LANSCE 7</u>

a) No spare target for the Lujan target station, no transport cask to exchange targets, and no receiving area for activated targets, are available. Target disconnecting and connecting procedures have not been established. This means that a major target failure requires a remote handling operation of several months instead of the few weeks expected from the upgraded target design (LRIP).
b) There are no repair or dismantling facilities for activated targets, posing disposal problems.

c) Target-external installations such as the cold box for cooling H_2 moderators and the target cooling appear near the end of their life.

Many of these shortcomings result from the fact that the previous improvement program LRIP was not completed due to lack of funds. While they cannot be redressed substantially before the coming running period, a minimum of measures must be taken during the shutdown of fall 2000 to bolster reliability for the run in 2001. On the accelerator side, a minimum of spare vacuum pumps, linac quadrupoles, and drift tubes must be procured. A vacuum engineer must be trained and a procedure for in-site drift tube leak repair instituted. On the target side, provisions must be made to allow a remote exchange of the Lujan target which requires a spare target, transport casks, a target repository area, and the establishment of the necessary target change procedures. Minimal repairs to the cold box and target cooling should also be high on the list of priorities.

Starting a second running period in 2001 before these fixes are completed invites serious and possibly lengthy interruptions of the beam delivery to Lujan. This would jeopardize the entire future of the Lujan center as a user facility. Therefore these upgrades must take first priority for the coming fall shutdown.

LANSCE 5

LANSCE 5 has the responsibility for the LANSCE linac and PSR RF power systems and for RF power development for APT. Recently, members working mainly on SNS have been split off into a separate SNS Division. The two groups will remain in close contact.

More than half the present group (~30) is engaged in operations and maintenance of the LANSCE RF systems which consist of four 200 MHz and forty-four 800 MHz stations and the PSR buncher. Availability has been a very respectable 98% and 95% for the past two years.

However, the group is concerned over component ageing and inadequate investment directed toward updating the equipment. The group has started a program to replace 800 MHz system high voltage capacitors with a new and safer installation arrangement. Also it has developed a new 200 MHz power amplifier (PA) design using a modern power tube so as to not have to rely solely on the rebuilding of old tubes which are no longer available new. Prototype testing of the new PA is about to begin. This development effort is highly recommended as the original tube rebuilding has been problematic for a number of years. The same tube is used by a number of national labs, including BNL and FNAL.

Funds will be needed over a number of years to carry out these two improvement programs.

The group is justifiably proud of the system it has designed, built and commissioned for LEDA, the test injector for APT. LEDA has operated at 0.7 MW beam power and 11 MeV energy. The RF systems provide 4.8MW CW at 350MHz and 2 MW CW at 700 MHz. The design provides for the possibility of switching between klystrons in the event of failure of one. The low lever RF controls are based on modern DSP technology.

The group has done an outstanding job in keeping on top of the operations and improvements, and in the construction of new state of the art systems.

<u>Comments on SNS RF Activities</u>

LANL has the responsibility for all the RF systems for SNS as well as the normal conducting section of the linac, linac physics design, and global controls. In order to carry out best this responsibility a new SNS division has been formed and about half of the LANSCE 5 group has been assigned to this new division.

Obviously the group would have preferred to stay as one unit and will remain co-located in order to continue to maintain technical synergy and maximum interchange of ideas and abilities. Under discussion is a concept of duel posting in order to maintain the group integrity. The "first " posting would be to the group that the individual spends most of their working time in.

The appropriate balance between line management (programmatic assignment) and matrix management is very important to fulfilling LANL's responsibilities in SNS most efficiently and cost effectively. SNS must have control of the key individuals to their effort. On the other hand temporary support and expertise needs can best be supplied from a matrixed organization.

It appears that the two divisions are coming to a reasonable understanding as to how best to proceed.

Work on SNS RF power systems has resulted in prototype development of a modern innovative converter modulator system and the development of a 2.5 MW 805 MHz klystron. Different RF design options are still under critical evaluation. Cost optimization and RF-beam control are key considerations.

LANSCE 9

LANSCE 9 is almost autonomous within the LANSCE Division. It appears to be a conglomerate of speculative AARD and High Power Microwave approaches, many of which are just being initiated. The group is attempting to bridge between new ideas in unclassified accelerator technology and defense applications.

There was not enough time allotted to presentation and discussion of all the various activities of this group for the review members to form a well based informed option of the program. (Nor were members necessarily expert in the areas under discussion.)

A number of topics were outlined:

27 compact pulsed power electronics
28 17 GHz high power sources
29 very high power klystron development
30 mm wave communication and microstructures
31 RF laser driven guns
32 FEL SASE
33 plasma acceleration
34 DARHT-THOR test stand
35 beam halo development predictions and experiments.

It was not clear how many of these programs were on-going and how many were new initiatives. Nor was it was it clear just what the funding and resource allocations and priorities were within the group.

That said, certainly a group like this is very important to the laboratory and to the accelerator physics community. It has done pioneer work on RF guns and SASE-FEL. It deserves to be reviewed to a larger extent.

APPENDIX C

Chronological History of LANSCE

(see separate PDF document)